

**THE
BIG AVIATION BOOK
FOR BOYS**



To James
from Harold A. R.



**The
Big Aviation Book
for Boys**

DEDICATED

*to the spirit and enthusiasm of youth
• • the guide and inspiration
of the leaders of to-
morrow.*



TIMES WIDE WORLD PHOTO

*Commander Byrd in his Antarctic Costume. Original printed
for the first time.*

THE
BIG AVIATION BOOK
FOR BOYS

Introduction
by
**COMMANDER
RICHARD E. BYRD**



Edited by
JOSEPH LEWIS FRENCH

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FOREWORD

NEW YORK, N. Y.

August 13, 1928.

I was glad when I heard that Joseph Lewis French was going to turn his attention to air adventures; especially because he planned to prepare a recital of them for boy readers.

Aviation still belongs essentially to youth. The boy of today may be flying in five years. Certainly in ten he will be a factor in the progress of flying if only as a regular passenger.

Another thing, it is the duty of those of us who are here today to preserve in accurate detail the history of flying for those who come after us. Mr. French has done this before for the sea. He has now done it equally well for the air.

I write this brief word on the eve of sailing south toward the antarctic. With me will go a Boy Scout and three other young men who are still undergraduates. One reason why I am taking these lads is that the spirit and enthusiasm of a man is greatest before he is twenty-five. I feel they will be a tonic stimulant for my whole party.

And America, as well as I, depends on her boys.

Richard E. Byrd

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THE STORY OF THE AIRSHIP

BY T. J. C. MARTYN

IN the recent voyage of the Graf Zeppelin across the Atlantic Ocean to these shores there is more to be read and understood than the lessons of successful dirigible navigation and construction; it opens a new chapter in the annals of lighter-than-air craft, one that has a rich background of human endeavor in which skill and courage have played equal parts. The Graf Zeppelin, in its construction and in its performance, marks the latest advances in its own sphere of aeronautical science, an advance that most certainly will have important influences upon the development of the airship. At the same time its triumphant success is to be measured in large part by the labors and researches of those pioneer aeronauts who by their perseverance made lighter-than-air craft possible.

Just as the history of the airplane cannot be divorced from the story of the glider, the history of the dirigible is inseparably bound up in the story of the balloon. In theory both types of aircraft have been studied since ancient times. Flight through the air has lured man all through the ages as perhaps few other things have, and it continues to weave its spell over millions of people today. According to tradition it was Archytas

of Tarentum who invented the kite, the forerunner of the airplane, and Archimedes who first discovered the theory that a body will rise in the air if its total dead weight is less than that of the air which it displaces.

But the history of the lighter-than-air craft is shorter than that of heavier-than-air craft and it is marked by no dramatic culmination such as attended the first flight of a powered airplane at Kitty Hawk twenty-five years ago, although the first success of the balloon had a more immediate public response than had the successful demonstrations of the Wright brothers, which received no more than a paragraph in a metropolitan newspaper several days after the event.

America is the home of the airplane, but it was France that fathered the balloon. To Joseph and Etienne Montgolfier, sons of a prosperous paper manufacturer of Annonay, goes the honor of constructing the first successful balloon, lifted through the agency of hot air. Sir Walter Raleigh, who was deputed by the British Air Ministry to write the history of the Royal Air Force, described their success as due to a "happy chance," although their achievement was in reality due to the observation of clouds floating through the air and was based on scientific deductions. It was on June 5, 1783, that they flew the first balloon. It was a spheroid 110 feet in circumference, inflated with hot air from a fire of wood shavings, and it flew to a height estimated at 6,000 feet and traveled a mile before it lost its buoyancy and fell.

The event aroused the wildest enthusiasm in Paris and the Mountgolfiers were at once summoned to the French Court

at Versailles where, in the midst of an admiring throng and in the presence of Louis XVI and Marie Antoinette, they liberated another hot-air balloon, to which was attached a basket holding a live sheep, a cockerel and a duck. The physicist Charles at once perceived the advantage of using hydrogen and for a brief spell ballooning was the craze of the age. Success had come to the balloon almost over night in contrast to the decades—one might by only a slight stretch of the imagination say centuries—of patient experimentation that preceded the advent of a glider big and strong enough to carry a man.

When the Englishman, Cayley, and the German, Lilienthal, indicated and proved the possibilities of the glider, attention was immediately centered upon the invention of a powered airplane. So with the balloon half a century earlier. Flight in a lighter-than-air craft had been effective and effectually demonstrated and man soon turned to the problem of transforming the balloon into a dirigible ship, that is to say, into an aircraft capable of being driven in any desired direction. The history of the balloon was not a long nor a glorious one. After many successful flights and after it had been put to military uses in the revolutionary wars with but inconspicuous success, the craze for ballooning waned and the pioneers struggled with their theories until the arrival of the steam and the internal combustion engines.

Here the real history of the dirigible begins, and it is a history replete with human patience and courage, fantastic notions and later with mechanical and engineering skill wrested

from actual experience in the air. The problem was to get a balloon to travel in any direction, even against the wind, instead of remaining exclusively at the mercy of the air currents—and even today the problem has only been partly solved, owing chiefly to the tremendous resistance offered by the framework of a dirigible to its passage through the air. Once a light engine had been invented the problem became one of constructing an aerostat strong enough to resist the strain of flying through the air and capable of control in the required direction.

Before this, however, many grotesque theories were put to the test. The first idea was to place a sail to one side of the balloon, a theory put forward by Thomas Martyn in England, despite the fact, not then comprehended, that a sail would have no effect, since there is no fixed point to which it can be attached, and the sail, therefore, travels through the air at precisely the same rate as everything forming part of the balloon. Oars were then thought of and tried, and although the idea was theoretically correct, it was practically unsound; for the oars had to be very strong and very large, and, moreover, to be effective they had to be rowed at a speed that surpassed human endurance.

Nevertheless, the Robert brothers of France successfully navigated a balloon with oars, hiring six sailors to do the rowing, and another aspiring inventor drafted plans for a mammoth balloon that was to have a galley of eighty oarsmen plying huge silken oars. The inventor, a French General by the name of Meusnier, later killed in the revolutionary wars,

was, nevertheless, to recognize that an egg shape would be the best for a dirigible balloon, and since the model he built inspired a host of aeronauts after him his name is important. The great problem of propulsion still remained and was neatly summed up by an anonymous poet:

*To Montgolfier the Invention's due,
Unfinished as it lies,
But his will be the Glory who
Direction's art supplies.*

The art of direction was not supplied until about 1850, although one earlier attempt came near to success. This was the theory of the Abbés Miollan and Janinet, who, utilizing quite correctly Newton's theory that every action must have an equal and opposite reaction, thought of supplying the propulsive energy by allowing hot air to escape from a hole at one end of the bag with enough force, as they hoped, to drive the balloon forward. Their experiments were delayed, for one reason and another, and an infuriated public, evidently fearing that it was being imposed upon, destroyed their balloon—a not uncommon experience for inventors.

In 1850 Henri Giffard came on the scene and earned for himself the title (though some dispute it) of father of the dirigible. He had assisted in that year a Swiss watchmaker to build a model dirigible that made successful flights against moderate winds. Borrowing a sum of money from friends, he built, next year, a full-sized ship, utilizing Meusnier's principle of a long cigar-shaped gas bag, sharply pointed at the

ends, and the suggestion of Francis Hopkinson of Philadelphia that a propeller be used (a suggestion made at the end of the eighteenth century, when screws were not even used for ships).

Giffard's airship had its gas bag, 143 feet long by 39 feet in diameter, covered with a network of cords drawn down beneath the balloon and attached to a long pole, to which the car was fixed. In the rear was a huge triangular fin designed to act as the rudder. The craft was powered by a steam engine developing one horsepower per 110 pounds of weight. Every precaution against fire was taken and on Sept. 23, 1852, he made a semi-successful flight—that is to say, he managed to get the ship to fly at an air speed of about four to five miles an hour, but the wind being stronger than that he actually went backward. He made several other small dirigibles and soon came to realize that he would need a much more powerful engine if a high speed were to be achieved. Accordingly he set to work and designed an enormous airship, which was to be 2,000 feet long and which he expected would have a speed of some forty-four miles an hour. Ill health intervened, however, and he died in 1882 without attempting his ambitious project.

The next important experiment in airship construction occurred in 1885, when the Frenchman, Captain Charles Renard, working with Captain Krebs, built the celebrated *La France*, having received a grant of money from Gambetta for that purpose. The *France* was 165 feet long and 27½ feet wide at its maximum width. It was cigar-shaped, but it was the first to use a streamlined bow, that is, a blunt instead of a sharp nose.

It was powered with an electric motor and made a number of successful flights at an average speed of about fourteen miles an hour, and in five out of seven flights over a period of two years returned obedient to its controls to its starting point. Why they did not use a gas engine is hard to understand, as the German Harlein had built and flown a small dirigible equipped with such motive power as early as 1872. Wolfert, another German, flew a dirigible in 1897 powered with a benzine motor, but unhappily his craft caught fire in the air and he was killed. A light, highly powered engine was, nevertheless, a vital necessity.

Hitherto dirigibles were either non-rigid or semi-rigid, that is, they had either no internal bracing within the gas bag, which retained its shape as the result of the internal pressure, or they were partially braced by means of a longitudinal girder and perhaps a few lateral spars and hoops. An Austrian named Schwartz was the first to build a rigid dirigible, but neither of the two ships was successful. It was left to the genius of Count Ferdinand von Zeppelin to perfect the rigid airship and it is he who is fairly to be considered the father of this type of craft—that type that millions of New Yorkers have recently seen flying gracefully over the city.

Not that non-rigid and semi-rigid airships died a natural death; they were developed continuously in both France and Britain, and even Russia favored them. Santos-Dumont, the wealthy young Brazilian who thrilled France at the beginning of the century with his daring exploits and who built dirigible after dirigible with a rare prodigality, is but one of the men who labored to perfect the semi-rigid airship. In some ways Dumont is the

prototype of Colonel Lindbergh, for his zest and enthusiasm and his love of flying for its own sake not only did much to stimulate popular interest in aeronautics, but won him a golden reputation in Europe, especially in France and England. The Lebaudy brothers, too, were active in designing and building non-rigids and semi-rigids; in fact, they brought the latter type to somewhere near its present state of efficiency, building for the French Government such famous airships as the *Jaune*, the *Lebaudy*, *La Patrie*, *La Republique*, *La Ville de Paris* and the *Clement-Bayard*, built for the Russians. Several of these ships met tragic fates, however.

THE FIRST ATTEMPT AT THE NORTH POLE

ANDREE AND HIS BALLOON

WE come now to the achievements of recent and living aeronauts, and among these the names of Camille Flammarion, the celebrated French astronomer, Gaston Tissandier, who, in 1883, was thought to have partially solved the problem of steering a balloon, and W. de Fonvielle are most distinguished. As with Glaisher, the impulse of the three famous Frenchmen just named was mainly scientific, but they have all come under the fascination of a pursuit which is perhaps the most romantic left to man.

M. Flammarion expresses his feelings in this impassioned address to his balloon as it lay formless in its shed before inflation:

"Inert and formless thing, that I can now trample under my feet, that I can tear with my hands, here stretched dead upon the ground, my perfect slave, I am about to give thee life that thou mayest become my sovereign. In the height of my generosity I shall make thee even greater than myself. O vile and powerless thing! I shall abandon myself to thy majesty, O creature of my own hands! and thou shalt carry me beyond my kingdom into thy own element, which I have created for thee; thou shalt

From *The Conquest of the Air*, British copyright.

fly off to the regions of storms and tempests, and I shall be forced to follow thee. I shall become thy plaything; thou shalt do what thou wilt with me, and forget that I gave thee life. . . .Perchance thou wilt deprive me of my existence and leave my corpse floating in the hurricane above, until thy perfidy, fatigued by its own exertions, shall fall like a blind monster in some desert place, or into the foaming waves, which shall swallow us up together!"

The name of S. A. Andree, the Swedish engineer, is famous for his attempt to reach the North Pole by means of a balloon. But had he never gone to seek death or glory in the frozen north, he would have been entitled to our notice for his wonderful aerial voyage across the Baltic Sea in October of 1893. He had ascended for purely scientific purposes on the 19th of that month, and in making his descent found to his horror that he had drifted out to sea, where his fate was certain unless he could reach Finland or fall in with a vessel. He did sight a steamer, but the captain, afraid of an explosion if the balloon came near his fiery funnels, put out all fires, and so could not move to Andree's assistance. In this critical condition the aeronaut maintained perfect possession of himself, and now determined on reaching Finland.

The wind greatly increased, the balloon sailing on at eighteen miles an hour, often dipping towards the water, but never touching it. To prevent that danger, Andree cut away the anchor which he had been unable to raise—a desperate expedient. At dusk he was flying over the cliffs of Finland, but the wind changing, blew him along the coast. The remainder of his extraordinary voyage is best told in his own words:

"For ninety minutes I was standing on the edge of the car,

with some ballast in my hands, ready to throw it out in case of danger of collision with a cliff. Suddenly I saw a sharp light. I supposed it was a lighthouse; but there appeared now two, then three lights; it was evidently a building. For one moment I lost my presence of mind and failed to grapple the rope to the ventilator and hang on to it with all my powers. Now it was too late. I had passed the island, and the balloon came down into the water. I was lying in the bottom of the car, and the water rushed in with such force that I could not move. Most of the way to the next island I was under water.

"But this could not continue. At length, after much turning and twisting, I succeeded in getting my legs over the edge of the car, just when the balloon swept over the next cliff. It was a wonder I escaped without having them broken. I tried several positions, but the car was so unsteady that I was never safe; but I could not endure it much longer. I felt myself so feeble that it would have been an impossibility for me to try to hold the balloon. I had only one course now to pursue—to save my life. Passing over the next cliff, I jumped down. The balloon shot up in the air and disappeared.

"I was saved; but, alas! in what condition and for how long a time! I had hurt my leg in falling, and could not stand, so I crept round the cliff in search of shelter; but none was to be found. It was now between seven and eight o'clock. For a couple of hours I shouted aloud, in the hope that I might be heard by some passing boat; but the raging storm took away the sound of my voice.

"I then turned my attention to making myself as comfortable

as possible for the night, though the prospects were anything but pleasant. I was wet through, my fur cap had blown away, and I had nothing to put on my head. This made me specially anxious, because my only chance of being rescued was to keep my head clear. I made a cap of some handkerchiefs and lay down on the cold ground, hungry and shivering, trying to keep up my courage if not my temperature. So passed the long night.

"At length day dawned. I was now able to stand, and, with my glasses, which I had fortunately round my neck, I saw in the distance the island over which I had passed the night before. In order to draw attention to my position, I took off my trousers and waved them in the air. Shortly afterwards I was glad to see a boat sail out from the island and steer straight for the place where I lay.

"I soon saw they had not set out in response to my signal, for the men never once looked in the direction of the cliff, and the boat passed me. I shouted myself hoarse; but in vain. I began to look about to see if I could make a raft out of the few trees there were; but as I had neither axe nor knife, I was obliged to give up the idea.

"When I returned to my sleeping-place, I found a boat close by. A man on the island had seen a big square boat, with an enormous sail, come sailing from the sea with a terrific sweep, and go flying over the ground, and again disappear in the sea. This was my balloon, or, rather, his description of it, for the islanders had never seen anything of the kind before.

"His curiosity was aroused, and early in the morning he went down to the beach with his glasses to see if he could find out

what the strange apparition could have been. He then saw my signals and put off to my rescue. I was quickly taken over to his home and well cared for."

But, as we have said, it is his attempt to make an aerial voyage to the North Pole that has rendered his name a familiar one throughout the world. His balloon was called the "Eagle," and resembled the ordinary aerostat, save that it also carried a sail; and the car, made to accommodate three persons, had a comfortable sleeping apartment, the roof of which served as a deck. Danskoe, in Spitzbergen, was the place selected to start from. The balloon was inflated there on July 23rd, 1896, but two months passed, the winter came, and the adventurers had waited in vain for a favorable wind. On July 11th, 1897, Andree and one companion, Strindberg, returned to Danskoe, and soon were favored by a south wind, borne by which the "Eagle" sailed away into the unknown.

It was a strange, bold scheme, and by no means so mad as some people thought. But nearly five years have passed and the voyagers have never returned, though countless reports about them, never quite authenticated, have been circulated from time to time, the latest coming from Kankakee, Illinois, to which town, it was stated, two citizens had returned late in the autumn of 1901, from a tour in the Hudson Bay territory, and according to a report alleged to have been made by these gentlemen, certain Indians in the spring of the previous year found the bodies of two white men and the basket of a balloon at a spot 900 miles north of the Moose River. The description of one of the bodies given to the Illinois tourists by the Indians tallied with that of Andree.

THE BALLOON IN WAR

NO sooner had a means of ascending into the air been discovered by the two Montgolfiers than its importance to the art of war was perceived. The first public exhibition of ballooning was in the year 1783. Europe was about to be turned by French revolutions and by the boundless ambition of Napoleon into an armed camp. It might be said that war at that period was the principal industry of the civilised world. It is not surprising, therefore, that in the year that saw the first demonstration of ballooning, Girond de Villette made an ascent and pointed out the advantages which must result from its use in war. Five years later the Committee of Public Safety considered ballooning as an aid to the defence of the country. And at this time Meusnier and Guyton de Morebeau were at work on the problem of the dirigible balloon. At the siege of Conde in 1794, attempts, which however proved futile, were made to communicate with the besieged by means of unmanned balloons.

In those days, as now, the urgent needs of the military spurred the inventiveness which would ultimately be for the benefit as much as for the destruction of men. Urged on by de Morebeau, the chemist La Voisier, who had discovered a new method of

From War in the Air. British copyright.

making hydrogen, set to work to turn it to practical account. "With the help of a physicist named Coutelle," writes Hildebrandt in his *Airships Past and Present*, "they proceeded to construct an oven which was to be used for preparing hydrogen by passing steam over red-hot iron. This was soon ready, and the balloon, 30 feet in diameter, was filled with the gas in the gardens of the Tuileries. The experiment succeeded so well that Coutelle was sent on a mission to General Jourdan, who was commanding the armies on the Sambre and Maas, with a view to induce him to make use of a captive balloon. It so happened that when he arrived in Belgium he was received by a member of the National Assembly. To him the idea of a military balloon appeared so ridiculous that he threatened to shoot Coutelle. General Jourdan, on the other hand, was much struck by the plan, and instructed Coutelle to return to Paris and procure the necessary materials."

But before we relate how aerial vessels were employed in battle for the first time, let us try to picture the impression made upon humanity by this wonderful new element in the affairs of the world. Carlyle, in his *French Revolution*, refers to this episode in a passage of singular interest:—

"What will not mortals attempt? From remote Annonay in the Vivarais, the brothers Montgolfier send up their paperdome filled with the smoke of burnt wool. The Vivarais Provincial Assembly is to be prorogued this same day: Vivarais Assembly members applaud, and the shouts of congregated men. Will victorious Analysis scale the very Heavens then?

"Paris hears with eager wonder; Paris shall ere long see. From Reveillon's paper warehouse there, in the Rue Saint Antoine (a

noted warehouse), the new Montgolfier airship launches itself. Ducks and poultry have been borne skyward: but now shall men be borne. Nay, Chemist Charles thinks of hydrogen and glazed silk. Chemist Charles will himself ascend, from the Tuileries Garden; Montgolfier solemnly cutting the cord. By Heaven, this Charles does also mount, he and another! Ten times ten thousand hearts go palpitating; all tongues are mute with wonder and fear; till a shout, like the voice of seas, rolls after him, on his wild way. He soars, he dwindles upwards; has become a mere gleaming circlet—like some Turgotine snuff-box, what we call ‘Turgotine-Platitude’; like some new daylight Moon! Finally he descends; welcomed by the universe. Duchess Polignac, with a party, is in the Bois de Boulogne, waiting; though it is drizzly winter, the 1st of December 1783. The whole chivalry of France, Duke de Chartres foremost, gallops to receive him.

“Beautiful invention; mounting heavenward, so beautifully—so unguidably! Emblem of much, and of our Age of Hope itself; which shall mount, specifically light, majestically in this same manner; and hover—tumbling whither Fate will. Well, if it do not, Pilatre-like, explode; and demount all the more tragically! So, riding on wind-bags, will men scale the Empyrean.”

The first military balloon factory was established towards the end of 1793 at Meudon. In the making of the envelopes for the balloons, by the way, was employed a varnish the secret of whose composition has been lost, just as has the secret of some of the unfading blues used by the Old Masters been forgotten. Whether this varnish was superior to all those at present in use is unknown, but it had a very high reputation. In the early mili-

tary balloon messages were sent down on paper by means of a small sand-bag along one of the ropes. Much the same method is now used for drawings and photographs. Speaking-tubes and flag-signals were also used.

The first military balloon division was formed on the 2nd of April 1794. The division included a drummer-boy! The uniform of this branch of the service consisted of a blue coat with black collar and facings and red braid. The buttons bore the word "Aerostiers." These soldier aeronauts were armed with swords and pistols. Within two months of their formation they were employed in the battle against the Austrians at Maubeuge in the first and one of the most dashing exploits in military ballooning.

The incident is a curious one. These soldier aeronauts, it appears, because they were artisans, were regarded with contempt by the swashbuckling, fire-eating warriors that in those days made battles, with the result that their commander, Coutelle, begged for an opportunity to distinguish themselves. This was given to them. An ascent was made under fire, and, one way and another, a sub-lieutenant was killed and two of the men were badly wounded. But the work done was invaluable. Never had been such accurate reports of an enemy's movements. The Austrians objected strongly, and not only objected, but had a superstitious dread of the aerial monster. General Jourdan, himself, made several ascents. In the same month ascents were made near Charleroi, and also at the battle of Fleurus, describing which Carlyle wrote: "Or see, over Fleurus in the Netherlands, where General Jourdan, having now swept the soil of Liberty,

and advanced thus far, is just about to fight, and sweep or be swept, hangs there not in the Heaven's Vault, some Prodigy, seen by Austrian eyes and spy-glasses: in the similitude of an enormous Wind-bag, with netting and enormous Saucer depending from it? A Jove's Balance, O ye Austrian spy-glasses? One saucer-scale of a Jove's Balance; *your* poor Austrian scale having kicked itself quite aloft, out of sight? By Heaven, answer the spy-glasses, it is a Montgolfier, a Balloon, and they are making signals! Austrian cannon-battery barks at this Montgolfier; harmless as dog at the Moon: the Montgolfier makes its signals; detects what Austrian ambuscade there may be, and descends at its ease. What will not these devils incarnate contrive?"

The battle was won, and the victory was attributed largely to the work of the balloonists. The Austrians announced that all balloonists who fell into their hands would be treated as spies.

From time to time balloons were used in wars in Europe, and in 1798 the First Company were ordered to Egypt. On the way thither the vessel containing them was sunk by a British man-of-war. A second company was captured. Then, in 1799, Napoleon disbanded the balloon division. Some of their material was sold and some was sent to Metz for storage. The story goes that Napoleon disliked the balloon after the day on which one sent up in his honour descended on the tomb of Nero.

But the French army had not had their last experience of balloons, apart from the revival in military aeronautics which took place about the year 1840. On entering Moscow in 1812, Napoleon's legions found in the camp of Voronzoff a large balloon bearing many thousands of pounds of gunpowder which was

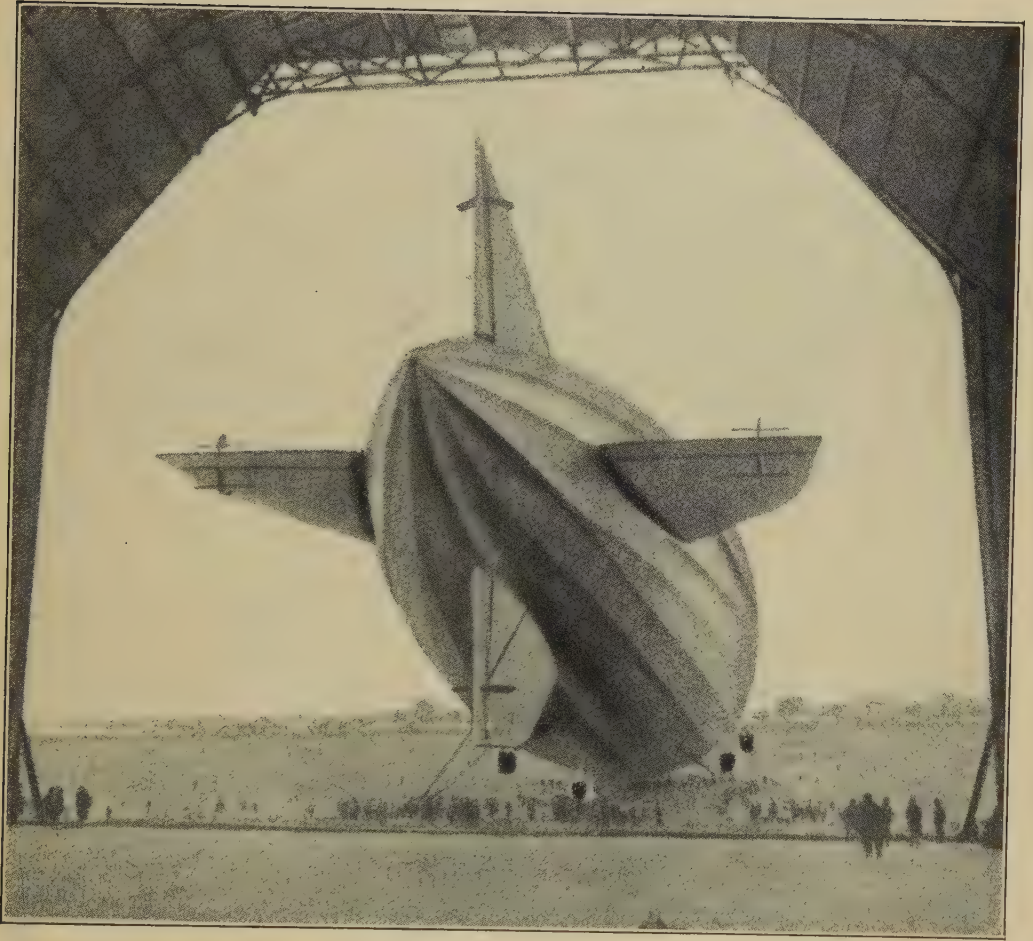


PHOTO BY TIMES WIDE WORLD

*The Graf Zeppelin being Drawn Out of Its Shed for
Its Flight Here*

to have been launched upon them. It was fitted with wings, and it was intended to hover over the French army and destroy Napoleon and his staff. The French made attempts to raise it, but without success.

In their bombardment of Venice in 1849 the Austrian army, at the suggestion of Uchatius, an artillery officer, employed balloon torpedoes. It was found that the range of the besieging batteries was insufficient, so Uchatius devised paper balloons, each capable of carrying bombs weighing 30 lbs. for thirty-three minutes. These were sent up from the windward side of the town with a time-fused contrivance. By this means bombs were dropped in the streets, and although little material damage was done the moral effect was great.

The next big occasion for the use of military balloons was provided by the American civil war, General MacClellan making excellent use of them with the co-operation of Professor Lowe. As an instance of what can sometimes be done by a balloon, it may be mentioned that a man named Le Mountain passed right over the enemy's camp, took very complete observations, and then, ascending higher, found a current of air which took him straight back to his friends. Ascents and descents under heavy artillery fire were made on several occasions, and on May 24, 1862, General Stoneman from his position in a balloon directed the fire of the artillery with great effect. Important work by balloons was done at Chikahoming, and later at Fair Oaks and Richmond, where a balloon was attached to a locomotive and moved from place to place. On August 16, 1862, the position in the James River of the fleet under Wilkes was exposed by a balloonist.

The siege of Paris brought the balloon into service under most romantic conditions. No fewer than sixty-six balloons left the besieged city, some to fall into the enemy's hands, others to convey important personages from isolated Paris, others to convey letters, and two to be lost at sea. In the same war the Germans formed two balloon detachments under the direction of the English aeronaut Coxwell, but very little service to the invading force was done.

The balloon service in besieged Paris was under the control of the brothers Eugene and Julius Godard and Yon and Dartois. The Godards had charge of the Orleans railway station depot, the other firm had the northern station. Godard's balloons were coloured red and yellow or blue and yellow, the balloons of Yon and Dartois were white. During the siege 66 aeronauts, 102 passengers, over 400 carrier pigeons, 6 dogs, and 9 tons of letters and telegrams were carried out of Paris through the air. Of the carrier pigeons, 57 returned to the city with messages. Five of the dogs were sent back, but nothing more was heard of them. Five balloons were captured by the enemy.

Some remarkable things were done with the aid of these balloons. On one occasion Tissandier threw down 10,000 copies of a proclamation addressed to the German soldiers. It demanded peace, but asserted that nevertheless France was prepared to fight to the end. On October 7th, Gambetta left Paris in the balloon "Armand Barbes" with the object of organising a fresh army in the country districts to march to the relief of the beleaguered city. The balloon came perilously near the earth close to the German outposts, and shots were fired, one striking Gambetta

in the hand. By throwing ballast the balloonists escaped before worse could befall them.

The first duel in the air occurred in connection with the siege of Paris. The French balloon "Intrepide" was seen floating near the fort at Charenton and a second balloon was in the air at the same time. On account of the vagaries of the air-currents these balloons were slowly approaching each other. Both flew the French colours. When very close together rapid shots were heard below, and one aeronaut was seen to fling himself into the network of his balloon and to cling to its side. The "Intrepide" descended rapidly, and suddenly the French flag of the second balloon was removed and a Prussian flag flaunted in its place. It is related that the French balloonist on reaching ground repaired a hole in his balloon and ascended again, continuing the fight with such effect that the Prussian balloon fell, and its occupant, now wounded, was rescued with great difficulty by a troop of Uhlans. Not much credence is given to this story, which, however, was believed in Paris at the time.

The Pigeon Post was conducted in such an interesting manner that it is well worth describing. It was organised by the Paris Pigeon Fanciers' Society. After one successful experiment a regular service was instituted. The despatches, of course, had to be very small and light, and recourse was had to microscope photography. By this means sixteen pages of print containing 32,000 words could be reduced to a small packet measuring 2 inches by $1\frac{1}{4}$ and weighing less than a grain. These messages were sent from all over France into Paris. One pigeon could carry twenty of them. On arrival at the pigeon-cote in Paris

the messages were taken from the bird, and the sheets, enlarged, were thrown on to a screen and thence copied. The charge was a halfpenny per word. The Prussians endeavoured to harass this post by sending up hawks, but without very good results.

Great Britain has used balloons in war as much as any country. In the Egyptian campaign of 1882 and in the South African trouble in 1885 balloons were employed with good results. In the Boer War of 1900 they were employed by General Buller on the Tugela and during the battles of Vaalkrantz, Spion Kop, and Springfontein. On the 10th of February a balloon was shot down by the Boer artillery. When Roberts and Kitchener rounded up Cronje, the position of the Boer army was located by means of balloons and the artillery fire was directed by signals.

Italy employed balloons in its Abyssinian campaigns and the Dutch used them in Atschin.

Kite balloons were used by both sides in the Russo-Japanese war; and in manœuvres in France, Germany, and England dirigible balloons and aeroplanes are now regularly employed, and with steadily increasing effect.

The first aeroplane used in actual war was employed by the United States in February 1911 to observe the Mexican frontier near Juarez during some revolutionary fighting in Mexico. The aviator was Charles Hamilton, and the machine a Wright biplane. Aeroplanes were also used by the military authorities in France during the "Champagne Riots" in 1911.

Curtiss demonstrated the possibility of alighting upon and ascending from a cruiser's deck, which had, however, to be adapted to the purpose by means of a large temporary platform;

and he also adapted an aeroplane to ascend from and alight upon water.

"The aeroplane has proved that it is a marvellous instrument of war," wrote Clementel in presenting the French War Minister's budget for 1911. Aeroplanes were extensively used in the manœuvres in Picardy in the autumn of 1910. Taking at random the report of one aerial reconnaissance, one finds that after a voyage of sixty-five minutes, during which the scout followed an appointed route of sixty kilometres, he was able to disclose four important positions occupied by the enemy. The aeroplane was kept at an altitude of about 1500 feet, and during part of the journey it followed the flight of one of the enemy's aeroplanes. The altitude, although not out of range, was a fairly safe one for an aeroplane moving at about forty miles per hour.

THE WELLMAN ATTEMPT FOR THE POLE

THE PROBLEM OF ESCAPE

NOTE. These short chapters from the book of Walter Wellman—*The Aerial Age*, N. Y. 1911, describe in graphic fashion that daring American journalist's rescue by a British steamship in the Atlantic Ocean when he was obliged to give up the second attempt ever made to reach the North Pole by the air route. Wellman made the venture starting from New York in 1910 in a balloon largely of his own devising. He had for a quarter century been in the employ of the Chicago Daily News who backed the enterprise.—Editor.

TO get ourselves out of the airship and safely upon the sea in the lifeboat was anything but a simple problem. We studied that problem carefully, you may be sure. The *America* was running an average of from 15 to 18 knots per hour with the wind. She was drifting broadside on to the course, which meant that as the lifeboat was launched into the sea, it, too, must take the water headside on. What we asked ourselves, over and over, was this: Will not the craft be instantly capsized and foundered? And if she be lucky enough to escape that fate, how about the equilibrator, tearing along a few feet in the rear? Will it not strike the struggling boat with the force of its two-tons moving rapidly through the water, act as a battering ram, and smash us to pieces?

These were pretty serious problems, indeed, and we considered them long and earnestly, though without the slightest trace of excitement. One proposal which found favor for a time was

From *The Aerial Age* by Walter Wellman.

that of Louis Loud to be let down in a boatswain's chair, and there, dangling between sea and sky and leaping from wave to wave, with his legs gripping the swaying hawsers, to cut the equilibrator away, thus removing that part of the danger. There is not the slightest doubt in my mind that the brave fellow would have accomplished this daring feat if he had had the chance; but upon reflection we decided it would never do to cut loose the equilibrator, for then the *America* would rise to the clouds, and when she came down again we had little in the way of ballast to lighten her and prevent her going plump into the sea, lifeboat and all.

We had this very day an illustration of the supreme importance of the equilibrator or something else to take its place in principle. The sun came out clear and warm. The gas absorbed heat and expanded rapidly. Tank by tank the serpent was lifted, and finally the entire device was in the air, and the ship rising. At this point a stupid bit of work was done. The only way to prevent a heating balloon or airship rising to a great altitude is to let out gas the moment the aerostat starts upward; for if it be permitted to rise, every yard of ascent means diminished atmospheric pressure, and consequently greater and greater expansion of the gas and more and more altitude.

On this occasion, notwithstanding my order to the contrary, Mr. Vaniman, who was nearest the valve-cords, opened still wider the air-valves instead of the gas-valves. The result was that instead of letting out of the distending balloon, for every thousand cubic feet of expansion, a weight of about 7 lbs. of hydrogen, there was let out a weight of about 80 lbs. of air. Many

thousand cubic feet were thus set free. Relieved of this load, the *America* shot upward—up so rapidly that we all suffered pains in our ears, whose membranes are adjusted to normal atmospheric pressure and find it difficult to accommodate themselves quickly to sudden changes, to a rapid ascent or descent. Up we went nearly 3,000 feet as shown upon our barograph. My aneroid dropped 1.8 inches in that needless ascent. Beautiful indeed was the view at that height, the weed-strewn waters of the eastern edge of the gulf stream below us, glistening in the sun, but it was a scenic delight obtained at the sacrifice of about one-seventeenth of our whole volume of gas—too high a price.

And when the airship started down—having found her equilibrium in the lighter air up high—she acquired a great momentum; again the pains in our ears; and but for the two-ton equilibrator dangling below her she would have gone souse into the sea. As it was, the serpent went in almost its full length before the *America* rebounded and rose 200 or 300 feet again like a rubber ball. Gradually she settled down. After that, orders to open the gas-valves the moment the tail crept up out of the water, were obeyed. Lying in the water-tight compartment of the lifeboat, watching the aneroid and the barograph, I could tell the moment the serpent was rising from the sea without looking over the side of the ship.

It was a serious question during this Monday afternoon if we could keep the *America* afloat during the night, as the gas cooled after the sun should set. We decided to try it, hazardous as it was—hazardous because if it should come on to blow dur-

ing the night, or rain, and thus drag the airship down to the ocean, we should be compelled to launch the lifeboat, no matter what the conditions. With a high wind or rough sea that would mean disaster. And it was with most anxious eyes I watched the barometer; we were approaching the area of the cyclone we had heard by wireless was coming up the coast, and which did strike Florida a few hours later with destructive force; had the glass shown any marked drop we should have taken to the lifeboat at once for fear of running into the edge of the storm.

Irwin told me that day a regular steamer left Bermuda Monday. Taking my chart, reckoning our position and course, and also the course and probable speed of the steamer, my conclusion was we should have at least a chance to pick her up Tuesday forenoon. It is always well to be an optimist. And if we had to launch the lifeboat, and run the risk of foundering and being smashed by the steel serpent, it would be pleasant to have a steamship somewhere in the neighborhood.

This third night out, a bright, full moon brilliantly illumined the waters. Wind from the northeast, about 15 to 18 miles per hour. Warmer, and the gas did not contract as much as we had feared. Not so difficult to keep afloat. Only a little lubricant and remaining parts of the motor thrown overboard. Barring the uncertainty as to how we were to get out of the dilemma, an agreeable experience. Most of the crew slept fairly well—and heaven knows they needed it. I had had more rest, and stood watch most of the night, eyes alert for signs of a ship—which I had a belief we should find. I am not a fatalist, nor superstitious, nor anything of that sort. But I had been in so

many tight corners, and always getting out of them with an approximately whole skin, that not for a moment did I doubt we should get out of this one, sometime, somehow.

That Bermuda steamship would be about right. I looked for her so intently, and at times so drowsily, my eyes began seeing things in the gleaming horizon or the gloomier depths covered by passing clouds. I saw a hundred steamers, some of them full electric lighted from stem to stern; trains of cars, rushing automobiles, tall buildings shining with lights. Then I shook myself, and saw nothing at all, only to drowse again, and have more optical delusions; then rouse, and nibble, and smoke.

We ate at all times, cold ham, ship's biscuits, tinned meats, Horlick's malted milk tablets, drank much water, and not an ounce of spirits was used on the trip. The cat ate, too; now the garret was not so strange. We were all settling down to the strange life.

But we knew, each one of us, this was our last night; we could keep the *America* up during the following day, Tuesday, but when night fell again, and the sun set and the gas cooled, down she must come and into the lifeboat we must go, be the conditions for launching what they might—favorable or fatal. We have not enough ballast left for another night.

How is the barometer? Is the West Indian cyclone anywhere in the neighborhood? Where is that Bermuda steamer? And if we don't see her, what is to become of us?

At four-thirty Tuesday morning I thought I saw the lights of a ship; but had so often deceived myself that I looked again, long and carefully, before crying out. This time it was sure.

I called to my mates; told Vaniman to get out some sort of torch or signal; roused Irwin and all the others. Vaniman soaked some waste with gasoline, lighted it, suspended the blazing mass from a wire; the steamer changed her course—they had seen us.

Irwin tried his wireless but got no response. Then he seized the electric "blinker" and with Morse dashes and dots in flashes of light signaled to the steamer. Her officers replied in the same fashion. We told them we wanted them to stand by, prepared to help us, and they said they would do so. We asked the name of the ship; she was the *Trent*—the Bermuda steamer we had been looking for! Then Irwin signaled we had wireless aboard, and in a short time Mr. Ginsberg, the *Trent's* operator, was got out of bed. From that on we conversed freely back and forth by wireless. The *America* kept drifting, and the *Trent* followed us, having about all she could do to keep up at her topmost speed.

Strange chance that brought these two ships together—that gave us the pleasure of establishing another record, the first rescue of an airship by a steamship. If we could not reach Europe with the *America*, it seemed the fates had conspired to make our adventure as thrilling and dramatic as if a Sardou or a Belasco had written it all out for us, and we were merely rehearsing. If the *America* had drifted a few miles faster or slower, or half a point of the compass to the right or left; if the wind had not shifted to the eastward an hour or two earlier in the morning; and if the *Trent* had not on this voyage for the first time visited a Cuban port before starting to New York, thus being out of her regular schedule, the ship of the air and the ship of the sea would not have come together. And in that case what would have become of us? We have not the slightest idea.

Navigator Simon, with the instinct of the brave sailor, soon blurted out that we'd better stick to the *America* and make a run for it. But that was instinct, not reason. We should have been forced to leave our ship within twelve hours at most, and had we run into the cyclone area, as was not improbable, it might have gone very hard with us. The chance for safety at hand, it would have been madness to go on, with nothing to be gained by the further hazard.

But how to get out of the airship and upon the *Trent*? It was not as easy as it looked. In fact, it was that same big problem we had so often and so anxiously considered. There was the danger that the lifeboat would be swamped or crushed in launching her. But we could find no other way. Vaniman did, indeed, dream of having the *Trent* come up and get a line to us, when we were to be transferred to her deck by life-buoys. An effort was made to attach a line, but it was lucky it was not successful, for if it had been probably the straining of the line would have pulled the steel car of the *America* in pieces and thrown us into the sea. Captain Down came very near us, incurring the danger of collision or of the ignition of the balloon by sparks from his smokestacks, but he handled his ship with great skill and fine judgment. Other plans were suggested and discussed, the *Trent* patiently following, her passengers now all on deck to witness the rare spectacle, and, as they afterward told us, so fearful for our fate that many of them were weeping or praying for our escape.

While we were hesitating and discussing, the *America* lost her equilibrium, and was in imminent danger of capsizing, end over

end. The air ballonet at one end had not been completely filled with air, the supply pipe having become deranged. Thus that end of the ship was lighter than the other; as this lighter end rose in the air the hydrogen rushed to the elevated part, greatly increasing the buoyancy there, and threatening disaster. None of us would have been surprised if in the next moment the airship had taken a header.

At this crucial juncture it was young Fred Aubert who leaped up into the car, ran forward to the disarranged pipe, put it in order, rushed to the engine room, started the service motor, and kept it going until the *America* was once more upon an even keel—a brave deed by the youngster of our party, of whom we are all proud. Had the *America* turned turtle, as she came very near doing, this is what would have happened, in all probability: The weight of the car would have been thrown upon one end of the balloon; the suspension would have stripped; the car would have been thrown into the sea. We five men in the lifeboat might have had some chance to save ourselves. But how much chance would there have been for the brave boy up aloft?

That is the sort of crew I had with me—every one of them. To bring out these qualities of courage, coolness, resourcefulness, good humor, was worth all the cost of the voyage.

To end the discussion of other plans of escape I announced that there was nothing for it but to go back to our first proposal and take our chances in the launching of the lifeboat. Everything was made ready for the maneuver. Vaniman passed the gas cord down within reach, and began opening the valve, letting out hydrogen and causing the airship to descend slowly; Simon

saw that all the boat tackle was in proper trim; we took our places in the boat, ready for the plunge.

But stop—the cat! Vaniman, who had wanted to leave Kiddo behind, now worried lest puss in the water-tight compartment should not have enough fresh air, and in his excitement asked for time to make an opening. Critical as the moment was, we had to laugh; there must have been enough fresh air in that compartment to keep kitty going for at least a month! We had to have our joke at Vaniman's expense, even if we were to die with it the next minute!

THE FATES WERE KIND THIS DAY

Down came the *America* nearer and nearer the sea. We gripped the lashings of the boat, and each of us held fast to a life-preserver. No, Vaniman had none—and called attention to the fact; so Louis Loud and Jack Irwin promptly gave him one of theirs and shared the other between them, though neither is much of a swimmer. Simon and Loud held the lines which were to release the boat at a single pull.

When the water was only four or five feet from us the word was given, snap went the two release-hooks simultaneously, up shot the lightened airship, down into the rough sea plumped our craft. She almost capsized, then righted herself in a twinkling. At that instant the dreaded equilibrator hit us, bruised Irwin and Loud, and stove a hole in the forward compartment of the boat, fortunately above the water-line—probably the kind fates were eager to make sure kitty had enough air—and it was all over. In ten seconds from the pull on the release-hooks we were calmly

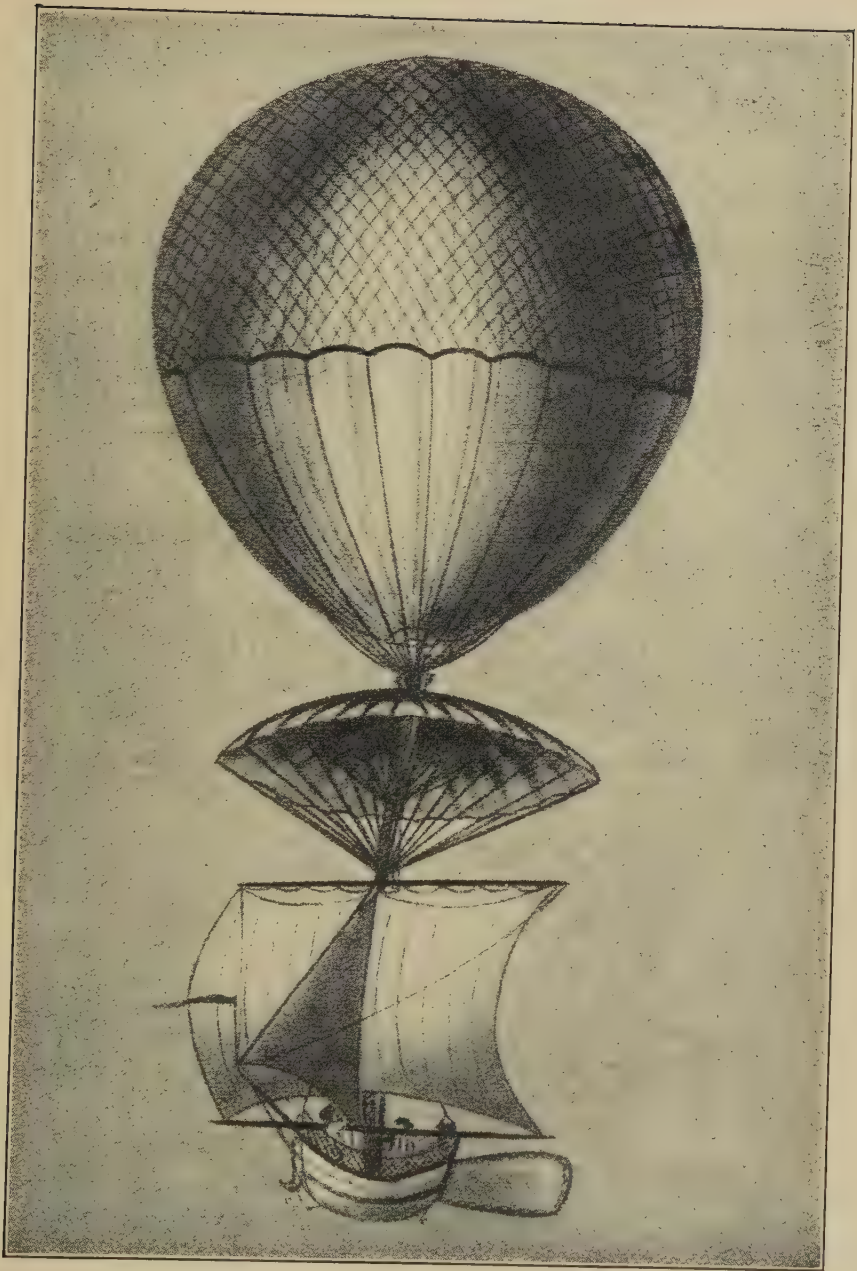
riding the waves in a staunch, well-provisioned and watered, fully-equipped lifeboat, prepared to sail to land or wait to be picked up by some passing ship. There was some satisfaction in the thought that we had really saved ourselves, as the *Trent* did not put a boat over into the water; which her officers were prepared to do, but could not for this reason; the moment the *Trent* should stop her engines and slacken speed sufficiently to permit of the safe launching of one of her boats, the fast-drifting *America* would have run away from her, and it was doubtful if the steamship would again be able to overtake us. As it was, we were running about as fast as the *Trent* could steam. We had foreseen this possibility, and prepared in case of necessity to start our motor and try to bring the *America* round under her own power so that the steamship might overhaul us. For, to tell the truth, we were glad enough to have the ship somewhere near by when we resorted to the dangerous experiment of launching our lifeboat. Now we were in our boat, the cat and all, and barring accident or hurricane could probably have taken care of ourselves.

But there was the splendid and now famous *Trent*, a ship's length away, her passengers and crew waving welcome to us in their joy that we had escaped the perils which beset us. How good she looked—one of our men said she appeared to him as big as the *Waldorf-Astoria*. And how glad we were that we did not have to spend a week or ten days pounding about in the sea in a half open boat trying to reach land or meet a ship in a part of the ocean where ships are but rarely seen.

Still we were not quite out of danger. Almost before we could

realize it, before we had time to unship oars and get our somewhat clumsy craft under control, the *Trent* was upon us. Her prow, rising it seemed to us as high as a church, was coming straight for us at a speed of fifteen knots. Were we to be smashed to smithereens here within ten feet of safety and after escaping all these other dangers through which we had passed? Five seconds will tell the story. She is going to smash us! No, her sharp stem hits us a glancing blow on the side, we sheer off, we are running along her port quarter. We are all right. Indeed the fates are good to us this day; thrice within as many minutes they have resolved dubious chances in our favor.

But we are not yet aboard. One more chance at least one of us must run before safety is ours. As we spin along the iron sides of the big ship the sailors on deck throw us a line. Someone on our craft swings out to catch it. We all grab. I chance to be in the middle of the group of six. We all grip the line. But they have made it fast on deck, and our lifeboat is heavy, and the ship is running fifteen knots the hour. The line sings and burns through our fingers. In some way a hitch has come into the rope; the hitch is round my right hand; the others have let go, but I can't. The line winds round my fist, draws tighter and tighter, and it flashes through my mind that one of two things is sure to happen—my fingers will go with the rope, or I shall; and what chance shall I have to get out of the sea alive, dragging captive at the end of a line trailing at fifteen knots? Of course it was only a flash; for in two seconds it was all over—and strange to say, neither happened. My fingers were not torn off—I was not dragged into the sea; only a lacerated and bruised hand, that was all. Such a day for good luck!



An Early Design for a Dirigible Balloon with Sails

But this was not quite all. Just behind us the sea was boiling. We were nearing the propellers. One of our men cried out that we were lost. Were we going to be cut to pieces by those rapidly revolving blades of the ship the fates had sent to save us? Into the whirlpool we drifted, and for a moment the outcome was rather doubtful; but the motion of the waters sent us safely past the propellers. The *Trent* was running away from us. We were rolling in the trough of the sea. "That must have been our ninth escape from Davy Jones' locker," quoth sailor Simon; "told you it was a good thing to have a cat along—cats have nine lives!"

At last we were safe on board the *Trent*, where we were received with amazing kindness by Captain Down, his officers and crew, and all the passengers. Soon we were again in wireless communication with the shore, and learned of the more than generous interest and sympathy the people of the whole world had felt for us during our adventurous wandering, and for which my comrades and I feel more grateful than words can tell.

Upon a printed passenger list of the *Trent* there soon appeared this postscript:

Picked up at sea, from the Airship *America*, Oct. 18, 1910:

W. Wellman

M. Vaniman

M. Simon

L. Loud

J. Irwin

F. Aubert

The last we saw of our good airship, which had carried us, under her own power and drifting, a little more than a thousand statute miles over the sea, she was floating about 800 feet high,

375 nautical miles east of Cape Hatteras. A day or two later, in all probability, she disappeared beneath the waves; the gas-valve was tied open when we left her, and the big steel gasoline reservoir, with a capacity of 1,600 gallons, had been cut open so that the sea water could enter and sink it. With just a little moistening of the eyes Vaniman and I said good-bye to the big craft that had brought us so much trouble in this world—dropping us once upon a Spitzbergen glacier, a second time into the polar sea, and this third and last time into the Atlantic.

Good old *America*, farewell. Thank you for the noble comrades and rare experiences you have brought me, for the lessons you have taught us. You played your part in the game of progress. In the years to come many aircraft will cross the Atlantic; and you will be honored as the ship that showed the way.

THE BIRTH AND GROWTH OF THE AEROPLANE

ONE of the first principles of the biplane was proposed and explained by a British subject, Mr. F. H. Wenham, as far back as 1866. He pointed out that the lifting power of a surface can be economically obtained by placing a number of smaller surfaces one above another. Indeed, flying-machines were built by Wenham on this principle, with appliances for the use of his own muscular power. He did not, however, accomplish actual flight, although valuable results were obtained as regards the driving power of superposed surfaces.

After various further experiments in the same direction, it fell to H. von Helmholtz to emphasize the improbability that man could drive a flying-machine by his own muscular power. A period of stagnation followed. But interest was revived later, and fresh efforts were made, varying in importance, down to the experiments of Sir Hiram Maxim and Professor Langley.

These two eminent men, who took up the subject of flying in the last decade of the last century, came to their task with great scientific knowledge. Hitherto flying was associated in the minds of the public with failure and folly. Indeed, Sir Hiram

From Heroic Airmen and Their Exploits

Maxim once remarked that at the time he took up the subject it was almost considered a disgrace to any one to think of it. It was thought 'quite out of the practical question.' But the two great men now in mind were not to be turned aside by ridicule. 'They rescued aeronautics from a fallen position, and fired in its cause the enthusiasm of men of light and learning.'

Sir Hiram Maxim's experiments were on a large scale. He built the largest flying-machine that had then been constructed. It had 4,000 feet of supporting surface and weighed 8,000 lbs.; the screw propellers measured 17 feet 11 inches in diameter, the width of the blade at the tip being 5 feet. The boiler was of 363 h.-p. This remarkable machine had wheels and a railway line, and was restrained from premature flight by a system of wooden rails. But it proved unruly. It burst through the wooden rails, and flew in a wholly unexpected fashion for 300 feet!

Professor Langley's experiments carried flying still further. In 1896 he built a machine that flew for more than three-quarters of a mile. In this machine there was only 70 square feet of supporting surface, and the weight was only 72 lbs. It had a 1 h.-p. engine, weighing 7 lbs.

But Professor Langley had still to build a machine that would carry a man. This he did in due course, but when the machine was being put to the test over water, and at the very moment of being launched, it caught in the launching ways and was pulled into the water. Progress had, however, been made, and it is well worthy of note that of recent date an American aviator has unearthed Langley's machine and flown on it, thus giving posthumous honour to the inventor.

Following the professor's efforts, further progress was made by Mr. Octava Chanute, who introduced the important principle of making moveable surfaces. He also made use of superposed surfaces. But it was reserved for the two famous aviators, the brothers Wright, to bring the desired conquest of the air to a definite point.

Their first practical experiment was with gliding machines at Kitty Hawk, North Carolina, in 1900. They endeavoured with comparatively small surfaces to raise their machines like a kite by the wind. But they found that the wind was not always in their favour and often blew too strongly for their method. Consequently, they abandoned the idea, and resorted to flight by gliding. Their machines now had two superposed surfaces. They also introduced two highly important principles, namely, a horizontal rudder in front for controlling the vertical movements, and the principle of warping or flexing one wing or the other for steering purposes. Later a vertical rudder was added.

Writing of these improvements, Mr. Eric Stuart Bruce, Vice-President of the Aerial League of the British Empire, remarks that their importance cannot be over-estimated: 'We have only to look at the nature of their *raison d'être*, and observe the flight of seagulls over the sea. How varied are the flexings of nature's aeroplanes in their wonderful manœuvrings to maintain and recover equilibrium!'

A feature of these early experiments was the placing of the operator prone upon the gliding machine, instead of in an upright position, to secure greater safety in alighting and to diminish the resistance. This, however, was only a temporary expedient

while the Wrights were feeling their way. In the motor-driven aeroplanes the navigator and his companion were comfortably seated. After the experiment of 1901, the Wrights carried on laboratory researches to determine the amount and direction of the pressure produced by wind upon planes and arched surfaces exposed at various angles of incidence. They discovered that the tables of the air pressures which had been in use were incorrect.

As the result of these experiments the Wrights produced in 1902 a new and larger machine. This had 28.44 square metres of sustaining surfaces, about twice the area of previous experiments. At first the machine was flown in the manner of a kite, with a view of learning whether it would soar in a wind. Experiments showed that the machine soared whenever the wind was of sufficient force to keep the angle of incidence between four and eight degrees. Later, in 1903, screw propellers were applied and four flights made. Definite progress favoured the venture. Two hundred and sixty metres were covered at a height of two metres!

In the following year, 1904, there was further marked progress, many successful flights, some 'circular,' being made. In the next year came an astonishing achievement: The Wrights flew no less than $24\frac{1}{4}$ miles in half an hour. This was rightly deemed at the time a great flight forward. But a period of silence and seeming inactivity followed. It was not until 1908 that further revelations were made. It was then seen that the Wrights had not been idle. Indeed, it is said (and with obvious justice) that 'to the labours of the Wright brothers we owe the advent of the mobile and truly efficient military air scout.'

The earliest experiments in the construction of aeroplanes were, as we have seen, to a considerable extent made in France. The United States have also played an active part. Meanwhile England had not been idle. Mr. Henry Farman, the inventor of the Farman Biplane, was the first to apply the famous Gnome motor, in which seven or more cylinders revolved. The influence of this motor in facilitating flight generally has been remarkable. The early forms of aeroplane engines had proved unreliable, owing to the great speed demanded. Indeed, it is said that if the aeroplanes of the great European War were flying over the enemy's line with old-fashioned engines they would drop down into hostile hands as quickly as dying flies from the ceiling on the first winter day.

Side by side with the efforts of Mr. Henry Farman in the construction of biplanes, M. Bleriot gave his attention to the construction of monoplanes. After attempts, which unfortunately brought disaster and disappointment, he produced a machine which astonished by its remarkable performances the whole aeronautical world.

Simplicity was the keynote of the Bleriot monoplane. The machine in which M. Bleriot flew over the Channel in 1909 has been described by a well-known member of the Aeronautical Society of Great Britain as 'stretching like the wings of a bird on either side of a tubular wooden frame partly covered with canvas and tapering to the rear, with two supporting planes, rounded at the ends. At the front was placed the motor, geared direct to a 6 feet 6 inch wooden propeller, and on a level with the rear end of the planes. Immediately behind the engine was a

petrol tank, and behind that the aviator's seat. Near the end of the frame and beneath it was the fixed tail, with two moveable, elevating tips. The act of moving a lever backwards and forwards actuated the tips of the fixed tail at the back of the machine, and caused it to rise and fall. Moving the same lever from side to side warped the rear surfaces of the supporting planes. The act of pushing from side to side a bar on which the aviator's feet rested put the rudder into action and steered the machine.'

Still fresh in the memory is the flight in which the Bleriot monoplane carried M. Prior from London to Paris, covering 250 miles in three hours and fifty-six minutes. Later, a Bleriot monoplane carried M. Garros up to a height of 5,000 metres. At this height the engine broke down, but in virtue of wonderful gliding powers the machine was landed safely. It was this same type of machine that flew over the Alpine peaks, and later carried the first aeroplane post, flying from Hendon to Windsor in seventeen minutes.

Another monoplane which calls for special reference is the Latham Antoinette monoplane, which enjoyed the great distinction of being the first to fly effectively in a wind. Before the invention of this machine, aviators had only dared to fly in favourable conditions. It consisted of large, strongly constructed wings. The motor was about 60 h.-p. At the rear of the machine were fixed horizontal and vertical fins. At the end of the tail there were hinged horizontal planes for elevating or lowering the machine. The machine, with its ability to withstand high winds, gave great impetus to the adoption of the aeroplane for military

purposes. Latham, the inventor, performed some remarkable feats, and must be accounted an heroic pioneer in the more recent history of flying.

Progress continued on the lines indicated. But it is impossible, for obvious reasons, to touch upon the modern types of machines employed by Great Britain and her Allies. We may, however, deal briefly with certain outstanding types of enemy machines.

One of the most familiar German machines is the Aviatik biplane. The vital parts of this 'fighting dragon' are fortified with metallic 'capot.' The rest of the fuselage is also armoured. In the forepart of the fuselage a space is provided allowing the observer free movement for scouting, photographing, &c. The machine can be quickly erected and dismantled. The supporting surface consists of two planes of unequal dimensions, the upper plane being the larger. Stability is assured by a fixed plane prolonged by a rudder. Two 'ailerons' at the back of the upper planes give lateral stability. Steering is effected by means of a vertical rudder placed between the two portions of the horizontal plane rudder.

Another familiar type, the Etrich monoplane, is on the lines of the German bird-shape design. The wing-shaped supporting planes have upturned wing tips at the back, which are flexed up and down for the purpose of lateral stability. The back part of the tail planes is also moveable, and can be flexed for elevating.

The Germans also have large numbers of the well-known Albatross biplanes and various monoplanes of the Taube design, and also many waterplanes of the Albatross type. An inter-

esting feature of these machines is the fact that they are all double seated with the exception of the Argo type of monoplane.

The swiftly dashing scouting monoplane did not at first find favour with the enemy, but the war has brought many sudden and sweeping changes, and, following the much-vaunted Fokker, we learn of a German machine able to attain the astonishing speed of 120 miles an hour!

The Albatross, a much used type of German machine, was first made at Johnnisthal, near Berlin (about 200 of these machines were made in 1913). Mercedes motors are fitted capable of attaining a high speed.

In the Rumpler monoplane, another well-known German type, the wings are again in the shape of a dove's wings, the ends being flexible. 'The stability of the apparatus,' writes a well-known authority, 'is assured both by the shape of the wings and their flexibility. It is at once a combination of the inherent stability type and the depending on the warping of surfaces.'

The Rumpler biplane, as in the case of the Aviatik, is remarkable for the space provided for the pilot and observer. In this case also the fuselage is strongly protected. The upper plane varies from that of the majority of German machines; it is not made to move in the centre. There is a short moveable central plane, attached to the fuselage by four tubes. The other planes are fixed to this central plane.

WILBUR AND ORVILLE WRIGHT

Note:—This describes their first experiments among the hills of North Carolina.

BY CHARLES C. TURNER

BY long practice the management of a flying machine should become as instinctive as the balancing movements a man unconsciously employs with every step in walking; but, in the early days, it is easy to make blunders," says Wilbur Wright. He and his brother made most of their glides quite close to the ground. Often a glide of several hundred feet would be made at a height of a few feet or even a few inches sometimes. Their aim was to avoid unnecessary risk.

Fully half of their glides were made in winds of over twenty miles an hour. On one occasion they found they had been gliding in a wind of thirty-seven miles an hour. Of course such high winds require much greater readiness on the part of the operator than the low winds, since everything happens much more quickly, but otherwise the difference is not so very marked. "In those machines which are controlled by the shifting of weight, the disturbing influences increase as the square of the velocity, while the controlling factor remains a constant quantity. For this reason, a limit to the wind velocity which

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it is possible to encounter safely with such machines is soon reached regardless of the skill of the operator."

Since soaring is merely gliding in a rising current, it would be easy to soar in front of any hill of suitable slope if a wind blew of sufficient force to furnish support provided the wind were steady. But, by reason of changes in wind velocity, there is more support at times than is needed, while at others there is too little, so that a considerable degree of skill, experience, and sound judgment are required to keep the machine exactly in the rising current. So far their only attempts at soaring had been made on the Little Hill, which has a slope of only seven degrees. In a wind blowing from twenty-five to thirty-five miles per hour they frequently made glides of eight to fifteen seconds' duration with very little forward motion. Keeping within five or six feet of the ground, a momentary lessening of the wind-speed or a slight error in management was sufficient to bring about a landing in a short time.

"The wind had too little rising trend to make soaring easy. The buzzards themselves were balked when they attempted to soar on this hill, as we observed more than once. It would be well within the power of the machine to soar on the Big Hill, which has steeper slopes, but we did not feel that our few hours of practice were sufficient to justify ambitious attempts too hastily. Before trying to rise to any dangerous height a man ought to know that, in an emergency, his mind and muscles will work by instinct rather than by conscious effort. There is no time to think.

"No complete record was kept of all the glides made. In

the last six days of experiment we made more than 375, but these included our very best days. The total number for the season was probably between 700 and 1000. The longest glide was 622½ feet, and the time twenty-six seconds.

“On two occasions we observed a phenomenon whose nature we were not able to determine with certainty. One day my brother noticed in several glides a peculiar tapping as if some part of the machine were loose and flapping. Careful examination failed to disclose anything about the machine which could possibly cause it. Some weeks later, while I was making a glide, the same peculiar tapping began again in the midst of a wind-gust. It felt like little waves striking the bottom of a flat-bottomed row-boat. While I was wondering what the cause could be, the machine suddenly, but without any noticeable change in its inclination to the horizon, dropped a distance of nearly ten feet, and in the twinkling of an eye was flat on the ground. I am certain that the gust went out with a downward trend, which struck the surface on the upper side. The descent was at first more rapid than that due to gravity, for my body apparently rose off the machine till only my hands and feet touched it. Toward the end the descent was slower. It may be that the tapping was caused by the wind rapidly striking the surfaces alternately on the upper and the lower sides. It is a rule almost universal that gusts come on with a rising trend and die out with a descending trend, but on these particular occasions there must have been a most unusual turmoil during the continuance of the gust which would have exhibited a very interesting spectacle had it been visible to the eye.

"Irregularities of the wind are most noticeable when the wind is high, on account of the greater power then exhibited, but light winds show almost equal relative variations. An aviator must expect to encounter in every flight variations in velocity, in direction, and in upward or downward trend. And these variations not only give rise to those disturbances of the equilibrium which result from the travel of the centre of pressure due to the changed angle of incidence, but also, by reason of the fact that the wind changes do not occur simultaneously or uniformly over the whole machine, give rise to a second series of disturbances of even more troublesome character. Thus, a gust coming on very suddenly will strike the front of the machine and throw it up before the back part is acted upon at all. Or the right wing may encounter a wind of very different velocity and trend from the left wing, and the machine will tend to turn over sideways. The problem of overcoming these disturbances by automatic means has engaged the attention of many very ingenious minds, but, to my brother and myself, it has seemed preferable to depend entirely on intelligent control. In all of our machines the maintenance of the equilibrium has been dependent on the skill and constant vigilance of the aviators.

"In addition to the work with the machine we also made many observations on the flight of soaring birds, which were very abundant in the vicinity of our camp. Bald eagles, ospreys, hawks, and buzzards gave us daily exhibitions of their powers. The buzzards were the most numerous, and were the most persistent soarers. They apparently never flapped except

when it was absolutely necessary, while the eagles and hawks usually soared only when they were at leisure. Two methods of soaring were employed. When the weather was cold and damp and the wind strong the buzzards would be seen soaring back and forth along the hills or at the edge of a clump of trees. They were evidently taking advantage of the current of air flowing upward over these obstructions. On such days they were often utterly unable to soar, except in these special places. But on warm, clear days when the wind was light they would be seen high in the air soaring in great circles. Usually, however, it seemed to be necessary to reach a height of several hundred feet by flapping before this style of soaring became possible. Frequently a great number of them would begin circling in one spot, rising together higher and higher till finally they would disperse, each gliding off in whatever direction it wished to go. At such times other buzzards only a short distance away found it necessary to flap frequently in order to maintain themselves. But when they reached a point beneath the circling flock they began to rise on motionless wings. This seemed to indicate that rising columns of air do not exist everywhere, but that the birds must find them. They evidently watch each other, and when one finds a rising current the others quickly make their way to it. One day, when scarce a breath of wind was stirring on the ground, we noticed two bald eagles sailing in circling sweeps at a height of probably 500 feet. After a time our attention was attracted to the flashing of some object considerably lower down. Examination with a field-glass proved it to be a feather which one of the birds had

evidently cast. As it seemed apparent that it would come to earth only a short distance away, some of our party started to get it. But in a little while it was noticed that the feather was no longer falling, but, on the contrary, was rising rapidly. It finally went out of sight upward. It apparently was drawn into the same rising current in which the eagles were soaring, and was carried up like the birds.

"The days when the wind blew horizontally gave us the most satisfactory observations, as then the birds were compelled to make use of the currents flowing up the sides of the hills, and it was possible for us to measure the velocity and trend of the wind in which the soaring was performed. One day four buzzards began soaring on the north-east slope of the Big Hill at a height of only ten or twelve feet from the surface. We took a position to windward and about 1200 feet distance. The clinometer showed that they were $4\frac{1}{2}$ to $5\frac{1}{2}$ degrees above our horizon. We could see them distinctly with a field-glass. When facing us the under side of their wings made a broad band on the sky, but when, in circling, they faced from us we could no longer see the under side of their wings. Though the wings then made little more than a line on the sky, the glass showed clearly that it was not the under side that we saw. It was evident that the buzzards were soaring with their wings constantly inclined about five degrees above the horizon. They were attempting to gain sufficient altitude to enable them to glide to the ocean beach three-fourths of a mile distant, but after reaching a height of about 75 feet above the top of the hill, they seemed to be unable to rise higher, though they tried

a long time. At last they started to glide towards the ocean, but were compelled to begin flapping almost immediately. We at once measured the slope and the wind. The former was $12\frac{1}{2}$ degrees; the latter was six to eight metres per second (about fifteen miles per hour). Since the wings were inclined five degrees above the horizon and the wind had a rising trend of fully 12 degrees, the angle of incidence was about 17 degrees. The wind did not average more than seven metres—fifteen miles an hour. For the most part the birds faced the wind steadily, but in the hills they were compelled to circle or glide back and forth in order to obtain speed sufficient to provide support. As the buzzard weighs about 8 lbs. per foot of wing area, the lifting power of the wind at 17 degrees angle of incidence was apparently as great as it would have been had it been blowing straight upward with equal velocity. The pressure was inclined five degrees in front of the normal, and the angle of the descent was $12\frac{1}{2}$ degrees.

“On another day I stood on top of the West Hill, directly behind a buzzard which was soaring on the steep southern slope. It was just on a level with my eye and not more than 75 feet distant. For some time it remained almost motionless. Although the wings were inclined about five degrees above the horizon it was not driven backward by the wind. This bird is specially adapted to soaring at large angles of incidence in strongly rising currents. Its wings are deeply curved. Unless the upward trend amounts to at least eight degrees it seems to be unable to maintain itself. One day we watched a flock attempting to soar on the west slope of the Big Hill, which has

a descent of nearly nine degrees. The birds would start near the top and glide down along the slope very much as we did with the machine, but we noticed that whenever they glided parallel with the slope their speed diminished, and when their speed was maintained the angle of descent was greater than that of the hill. In every case they found it necessary to flap before they had gone 200 feet. They tried time and again, but always with the same results. Finally, they resorted to hard flapping until a height of about 150 feet above the top of the hill was reached, after which they were able to soar in circles without difficulty.

"On another day they finally succeeded in rising on almost the same slope, from which it was concluded that the buzzards' best angle of descent could not be far from eight degrees. There is no question in my mind that men can build wings having as little as or less relative resistance than that of the best soaring birds.

"The bird's wings are undoubtedly very well designed indeed, but it is not any extraordinary efficiency that strikes with astonishment, but rather the marvellous skill with which they are used. It is true that I have seen birds perform soaring feats of almost incredible nature in positions where it was not possible to measure the speed and trend of the wind, but whenever it was possible to determine by actual measurement the conditions under which the soaring was performed it was easy to account for it on the basis of the results obtained with artificial wings. The soaring problem is apparently not so much one of better wings as of better operators.

"The first flights with the power-machine were made on the 17th of December 1903. Although a general invitation had been extended to the people living within five or six miles, only five were willing to face the rigours of a cold December wind to see, as they no doubt thought, another flying machine *not* fly. The first flight lasted only twelve seconds. The fourth lasted fifty-nine seconds.

"In the spring of 1904 experiments were continued on Huffman Prairie at Simms Station, eight miles east of Dayton. The new machine was heavier and stronger, but similar to the one flown at Kill Devil hill. When it was ready for its first trial every newspaper in Dayton was notified, and about a dozen representatives of the Press were present. Our only request was that no pictures be taken and that the reports be unsensational so as not to attract crowds to our experiment-grounds. There were probably fifty persons altogether on the ground. When preparations had been completed a wind of only three or four miles was blowing—insufficient for starting on so short a track—but since many had come a long way to see the machine in action, an attempt was made. To add to the other difficulty the engine refused to work properly. The machine after running the length of the track slid off the end without rising into the air at all. Several of the newspaper men returned the next day, but were again disappointed. The engine performed badly, and after a glide of only sixty feet the machine came to the ground. Further trial was postponed until the motor could be put in better running condition.

"We had not been flying long in 1904 before we found that

the problem of equilibrium had not as yet been entirely solved. Sometimes in making a circle the machine would turn over sideways despite anything the operator could do, although under the same conditions in ordinary straight flight it could have been righted in an instant. In one flight, in 1905, while circling round a honey locust-tree at a height of about fifty feet, the machine suddenly began to turn up on one wing and took a course toward the tree. The operator, not relishing the idea of landing in a thorn-tree, attempted to reach the ground. The left wing, however, struck the tree at a height of ten or twelve feet from the ground, and carried away several branches; but the flight, which had already covered a distance of six miles, was continued to the starting-point.

"The causes of these troubles—too technical for explanation here—were not entirely overcome till the end of September 1905. The flights then rapidly increased in length, till experiments were discontinued after the 5th of October, on account of the number of people attracted to the field. Although made on a ground open on every side and bordered on two sides by much-travelled thoroughfares, with electric cars passing every hour, and seen by all the people living in the neighborhood for miles around, and by several hundred others, yet these flights have been made by some newspapers the subject of a great mystery."

At the time scarcely anybody attached any credence to the stories of the flying experiments at Kitty Hawk. They were not, as a matter of fact, studiously kept as a secret by the Wright Brothers. Many people witnessed them. But in

Europe they were regarded as newspaper sensationalism, and Bennet Burleigh, the war correspondent, who witnessed some of them and wrote an account of them in the *Daily Telegraph*, found that the general public were not prepared to welcome the conquest of the air.

It is not necessary to detail here the later career of the two brothers. They found that their own countrymen were unsympathetic. All the experiments had been conducted at their own expense, and attempts to secure the aid of rich Americans failed. In France, however, they met with enthusiasm. Their success on European soil in the summer of 1908 was at once acknowledged by the characteristically warm-hearted and imaginative French; and coming, as it did, at the time when Frenchmen were giving particular attention to the same problem it found an enlightened public opinion. The French were ready to acknowledge that the American school of flight was superior as regards achievement, but they were quick to oppose their own theories to it. For instance, the French aviators would have nothing to do with the tailless principle. They demanded automatic stability, and this they sought to obtain in the earlier machines, not only by means of a large tail, but also with the aid of vertical plane surfaces dividing two main planes into boxlike compartments. All this was before the triumphant monoplane had made its appearance.

It was on August 8, 1908, that Wilbur Wright made his first flight in Europe, and on various occasions he flew at Houandieres, Auvours, Pau, Chalons, Le Mans, Berlin, and elsewhere. His first flight in France was almost exactly two

years after Santos-Dumont's first aeroplane ascent. In the autumn of 1908 Wilbur Wright took up various passengers, among the first being Charles Stewart Rolls, who soon afterwards became a pupil. Rolls was the first English martyr to the motor-driven aeroplane, being killed at Bournemouth on July 2, 1910, soon after making the double crossing of the English Channel on his Wright machine.

It was while Wilbur Wright was making his early flights in France that his brother Orville, and Lieutenant Selfridge, of the United States army, had a terrible accident at Fort Meyer, when the latter was killed and the former severely injured. The accident was due to the transmission gear of the motor breaking.

Among the many distinguished people Wilbur Wright took up into the air was the German Crown Prince, on October 3, 1909. The two brothers received the gold medal of the Aeronautical Society of Great Britain in the same year.

Orville Wright achieved a flight of over an hour's duration as long ago as September 9, 1908, and on September 12th he stayed up for one hour and fourteen minutes. These feats created a tremendous impression at the time and did much to destroy the callousness and indifference which prevailed, especially in this country. On December 31st of that memorable year Wilbur Wright made a flight of two hours and nineteen minutes. He also demonstrated that his pupils could become adept after spending a few hours in the air, and his pupils in their turn became teachers.

One little incident revealed the real partnership which

existed between the two brothers. The Wrights won the Michelin prize of £800 in 1908, and at the presentation Wilbur, having expressed his thanks, calmly divided the notes into two packets, and without a word handed one of them to Orville, while he put the other into his pocket.

The devotion of the two American experimenters to their work was shown in their manner of living. In 1909 they were still living with their father and sister in the wooden house they had grown up in from the time when they were all children. The workshop where they make their engines was within a quarter of a mile, and was the same where, six years before, they were turning out Wright bicycles. Even closer to the house was the little printing-works, where, before making bicycles, they expended their unlimited energy and ingenuity, not only in printing a newspaper, but in making the printing-machine, which they constructed out of pieces of wood and bits of string. This Robinson Crusoe printing-press was only designed for home use. At Le Mans, Wilbur Wright lived in his aeroplane shed, and was thereby enabled to keep guard over his treasures.

THE FIRST AEROPLANE FLIGHT

JESSIE E. HORSFALL

THE flights of their glider in 1902 convinced Wilbur and Orville Wright of the efficiency of their system of maintaining equilibrium and the accuracy of the laboratory work upon which the design of their glider was based. They then felt they were prepared to calculate in advance the performance of machines with a degree of accuracy that had never been possible with the data and tables used by their predecessors. Before leaving their camp at Kitty Hawk, North Carolina, in 1902 they were at work on the general design of a new machine which they proposed to operate with engine-driven propellers.

Upon their return to Dayton they wrote to a number of automobile and engine builders stating the purpose for which they desired an engine, and asking whether one could be furnished that would develop eight brake horsepower, with a weight complete not exceeding 200 pounds. Most of the companies answered that they were too busy with their regular business to undertake the building of such an engine, but one company replied that they had engines which weighed only 135 pounds and rated at 8 h.p., according to the French system of ratings. It had but a single cylinder of 4 inch bore and 5

From the Aero Digest N. Y.

inch stroke and its power probably was much overrated. Unless it would develop a full 8 brake horsepower it would not serve its purpose.

Finally the Wright brothers decided to build an engine themselves. They designed an engine of four cylinders with 4 inch bore and stroke, weighing not over 200 pounds including all accessories. Up to that time their only experience in the building of gasoline engines had been in the construction of an air-cooled engine, 5 inch bore and 7 inch stroke, used to run the machinery in their small workshop. To be certain that four cylinders of the size they had decided upon would develop the necessary 8 h.p. they first fitted them into a temporary frame of simple and cheap construction. Six weeks from the time the design was started they had the engine on the block testing its power. There was no provision for lubricating either cylinders or bearings while this engine was running and for that reason it was not possible to run it more than a minute or two at a time. In these short tests the engine developed about 9 h.p. They were then satisfied that with proper lubrication and better adjustments a little more power could be expected. The completion of the engine was therefore proceeded with at once.

While their assistant, Mr. C. E. Taylor, was engaged with this work, Wilbur and Orville were completing the design of the machine itself. The preliminary tests of the engine having indicated that more than 8 h.p. would be secured, they felt free to add enough weight to build a more substantial machine than originally contemplated.

Their tables of air pressures and experience in flying with the 1902 glider enabled them to calculate the thrust necessary to sustain the machine in flight. But to design a propeller that would give this thrust with the power at their command was a matter not yet seriously considered. Data on air propellers was not available but they understood that an efficiency of 50 per cent with marine propellers was not unusual and that it would be necessary only to learn the theory of the operation of marine propellers from books on marine engineering, substituting air pressures for water pressures. Several such books were secured from the Dayton Public Library. All the formulae on propellers contained in these books were of an empirical nature and there was no way of adapting them to calculations of aerial propellers. As they could neither afford the time nor expense of a long series of experiments to find by trial a propeller suitable for their machine, they decided to rely more on theory than was the practice of marine engineers.

They agreed that a propeller was simply an aeroplane traveling in a spiral course. As they could calculate the effect of an aeroplane traveling in a straight course, they felt that to calculate the effect of one traveling in a spiral course would not be difficult. On further consideration they found it hard to find even a point from which to make a start, for nothing about a propeller, or the medium in which it acts, stands still for a moment. The thrust depends upon the speed and the angle at which the blade strikes the air; the angle at which the blade strikes the air depends upon the speed at which the propeller is turning, the speed the machine is traveling forward, and the

speed at which the air is slipping backward; the slip of the air backward depends upon the thrust exerted by the propeller and the amount of air acted upon. When any one of these changes it alters all the rest, as they are all interdependent. But these are only a few of the many factors that must be considered and determined in calculating and designing propellers. Their minds became so obsessed with it that they could do little other work. They engaged in innumerable discussions and often after an hour or so of heated argument would discover that they were as far from agreement as when they started, but that both had changed to the other's original position in the discussion. After several months of this study and discussion they were able to follow the various reactions in their intricate relations long enough to begin to understand them. They realized that the thrust generated by a propeller when not moving through the air was no indication of the thrust when moving forward. Their only recourse to really test the efficiency of propellers would be to actually try them on the machine.

For two reasons they decided to use two propellers. In the first place by the use of two propellers they could secure a reaction against a greater quantity of air and at the same time use a larger pitch angle than was possible with one propeller; and in the second place by having the propellers turn in opposite directions the gyroscopic action and torque of one would neutralize that of the other. The method adopted of driving the propellers in opposite directions by means of chains is now too well-known to need description here. They placed the engine to one side of the pilot so in case of a plunge headfirst,

the engine could not fall upon him. In their gliding experiments they had had a number of experiences in which they had landed upon one wing, but the crushing of the wing had absorbed the shock, so that they were not uneasy about the motor in case of a landing of that kind. To provide against the machine rolling over forward in landing they designed skids like sled runners extending out in front of the main surfaces. Otherwise the general construction and operation of the machine was to be similar to that of the 1902 glider.

When the engine was completed and tested, they found that it would develop 16 h.p. for a few seconds, but that the power rapidly dropped till, at the end of a minute, it was only 12 h.p. Ignorant of what a motor of this size ought to develop they were greatly pleased with its performance. With 12 h.p. at their command, they considered that they would permit the weight of the machine with operator to rise 750 to 800 pounds and still have as much surplus power as they had originally allowed for in the first estimate of 550 pounds.

Before leaving for their camp at Kitty Hawk they tested the chain drive for the propellers in their shop at Dayton and found it satisfactory. They found, however, that their first propeller shafts, which were constructed of heavy gauge steel tubing, were not strong enough to stand the shocks received from a gasoline engine with a light fly wheel although they would have been able to transmit three or four times the power uniformly applied. They therefore built a new set of shafts of heavier tubing, which were tested and thought to be strong enough.

They left Dayton, September 23, arrived at the camp at Kill

Devil Hill on Friday, the 25th. Provisions and tools had been shipped by freight several weeks in advance. The building, erected in 1901 and enlarged in 1902, was found to have been blown by a storm from its foundation posts a few months previously. While they were awaiting the arrival of the shipment of machinery and parts from Dayton, they put the old building in repair and erected a new building to serve as a workshop for assembling and housing a new machine.

Just as the building was being completed, the parts and material for the machine arrived. The next three weeks were spent in setting the motor machine together. On days with more favorable winds they gained additional experience in handling a flyer by gliding with the 1902 machine.

While Mr. Chanute was with them a great deal of time was spent in discussion of the mathematical calculations upon which the Wrights had based their machine. Mr. Chanute informed them that, in designing machinery, 20 per cent was usually allowed for the loss in the transmission of power. As they had allowed only 5 per cent, a figure arrived at by some crude measurements of the friction of one of the chains when carrying only a very light load, they were much alarmed. More than the whole surplus in power allowed in their calculations would, according to Mr. Chanute's estimate, be consumed in friction in the driving chains. After Mr. Chanute's departure, they suspended one of the drive chains over a sprocket and on it fixed a weight approximately equal to the pull that would be exerted on the chains when driving the propellers. By measuring the extra amount of weight needed on one side to lift the weight

on the other they calculated the loss in transmission. This indicated that the loss of power from this source would be only 5 per cent, as originally estimated. But while they could see no serious error in this method of determining the loss, they were uneasy until they had a chance to run the propellers with the engine to see whether they could get the estimated number of turns.

The first run of the motor on the machine developed a flaw in one of the propeller shafts. The shafts were sent at once to Dayton for repair, and were not received again until November 20. They put them in the machine and made another test. A new trouble developed. The sprockets, which were screwed on the shafts and locked with nuts of opposite thread, persisted in coming loose. They heated the shafts and sprockets, melted hard tire cement into the threads and screwed them together again. This trouble was over. The sprockets stayed fast.

Just as the machine was ready for test, bad weather set in. It had been disagreeably cold for several weeks, so cold that some days they could scarcely work on the machine. But it now began to rain and snow, and from the north a wind of 25 to 30 miles blew for several days. While they were being delayed by the weather they arranged a mechanism to measure the duration of flight from the time the machine started to move forward to the time it stopped, the distance traveled through the air in that time, and the number of revolutions made by the propellers. The watch, anemometer and revolution counter were all automatically started and stopped simultaneously. From data thus obtained they expected to prove or disprove the accuracy of their propeller calculations.

On November 28, while giving the motor a run indoors, one of the tubular shafts cracked! Solid tool-steel shafts of smaller diameter than the tubes previously used were decided upon. They would allow a certain amount of spring. The tubular shafts were many times stronger than would have been necessary to transmit the power of the motor if the strains upon them had been uniform. But the large hollow shafts had no spring in them to absorb the unequal strains.

Wilbur remained in camp while Orville went to get the new shafts. Orville did not get back to camp again till Friday, the 11th of December. Saturday afternoon the machine was again ready for trial, but the wind was so light a start could not have been made from level ground with the run of only 60 feet permitted by their monorail track; nor was there enough time before dark to take the machine to one of the hills, where, by placing the track on a steep incline, sufficient speed could be secured for starting in calm air.

Monday, December 14, was a beautiful day but there was not enough wind to enable a start to be made from the level ground about camp. They therefore decided to attempt a flight from the side of the Kill Devil Hill. Having arranged with the members of the Kill Devil Life Saving Station, located a little over a mile from camp, to inform them when the first trial of the machine was ready to be made, they were soon joined by J. T. Daniels, Robert Westcott, Thomas Beachem, W. S. Dough, and Uncle Benny O'Neal, of the station, who helped get the machine to the hill, a quarter-mile away. A track was laid 150 feet up the side of the hill on a 9 degree slope. With

the slope of the track, the thrust of the propellers and the machine starting directly into the wind, they did not anticipate any trouble in getting up flying speed on the 60-foot monorail track. But they did not feel certain the operator could keep the machine balanced on the track.

When the machine had been fastened with a wire to the track so that it could not start until released by the operator, and the engine had been run to make sure it was in condition, the brothers tossed up a coin to see who should make the first trial. Wilbur won. Orville took a position at one of the wings intending to help balance the machine as it ran down the track. When the restraining wire was slipped the machine started off so quickly he could stay with it only a few feet. After a 35 or 40-foot run, it lifted from the rail. But it was allowed to turn up too much. It climbed a few feet, stalled, and then settled to the ground near the foot of the hill, 105 feet below. The stop watch showed that it had been in the air just $3\frac{1}{2}$ seconds. In landing the left wing touched first. The machine swung around, dug the skids into the sand and broke one of them. Several other parts were also broken but the damage to the machine was not serious. The test had shown nothing as to whether the power of the motor was sufficient to keep the machine up, since the landing was made many feet below the starting point, but the experiment showed that the method adopted for launching the machine was a practical one. On the whole they were much pleased.

Two days were consumed in making repairs and the machine was not ready again till late in the afternoon of the 16th. Dur-

ing the night a strong cold wind blew from the north. When they arose on the morning of the 17th the puddles of water, which had been standing about camp since the recent rains, were covered with ice. The wind had a velocity of 22 to 27 miles an hour. They thought it would die down before long and so remained indoors the early part of the morning. But when 10 o'clock arrived and the wind was as brisk as ever they decided they had better get the machine out and attempt a flight. They hung out the signal for the men of the Life Saving Station. They thought that by facing the flyer into a strong wind, there ought to be no trouble in launching it from the level ground about camp. They realized the difficulties in flying in so high a wind but estimated the added dangers in flight would be partly compensated for by the slower speed in landing.

A track was laid on the smooth stretch of ground about 100 feet north of the new building. The biting cold wind made work difficult and they had to warm up frequently in their living room, where there was a good fire in an improvised stove made of a large carbide can. By the time all was ready, J. T. Daniels, W. S. Dough and A. D. Etheridge, members of the Kill Devil Life Saving Station, W. C. Brinkley of Mateo, and Johnny Moore, a boy from Nags Head, had arrived.

They had a hand anemometer with which they measured the velocity of the wind. Measurements made just before the first flight showed velocities of 24 to 27 miles per hour. The records of the Government Weather Bureau at Kitty Hawk gave the velocity of wind between the hours of 10:30 and 12 o'clock, the

time during which the four flights were made, as averaging 27 miles at the time of the first flight and 24 miles at the time of the last.

Wilbur, having used his turn in the unsuccessful attempt on the 14th, the right to the next trial now belonged to Orville. After running the engine a few minutes to heat it up he released the wire that held the machine to the track, and the machine started forward into the wind. Wilbur ran at the side of the machine, holding the wing to balance it on the track. Unlike the start on the 14th, made in a calm, the machine now facing a 27-mile wind started very slowly. Wilbur was able to stay with it till it lifted from the track after a 40-foot run. One of the Life Saving men snapped the camera for them, taking a picture just as the machine had reached the end of the track and had risen to a height of about 2 feet. The slow forward speed of the machine is clearly shown by Wilbur's attitude. He stayed along beside the machine without any effort.

The course of the flight up and down was exceedingly erratic, partly due to the irregularity of the air, and partly to lack of experience in handling this machine. The control of the front elevator was difficult on account of its being balanced too near the center. This gave it a tendency to turn itself when started, so that it turned too far on one side and then too far on the other. As a result the machine would rise suddenly to about 10 feet, and then as suddenly dart for the ground. A sudden dart when a little over a hundred feet from the end of the track, or a little over 120 feet from the point at which it rose into the air, ended the flight. As the velocity of wind was

over 25 feet per second and the speed of the machine over the ground against this wind 10 feet per second, the speed of the machine relative to the air was over 45 feet per second, and the length of the flight was equivalent to a flight of 540 feet made in calm air. This flight lasted only 12 seconds but it was nevertheless the first in the history of the world in which a machine carrying a man had raised itself by its own power into the air in full flight, had sailed forward without reduction of speed, and had finally landed at a point as high as that from which it started.

SENSATIONS OF FLIGHT—LEARNING TO FLY—BALLOON AND AEROPLANE

BY A MEMBER OF THE ROYAL BRITISH AIR FORCE

IT IS not easy to describe the sensation of flying. It is entirely different from that of ballooning; but perhaps before endeavoring from my own experience and that of others to give some idea of it, a few words on ballooning may prove a suitable introduction.

In a balloon the moment you leave the ground you feel absolutely motionless. It is the earth that recedes from you downward and, according to the wind, in a lateral direction. You may be travelling at sixty miles per hour, but you have no sensation of speed; there is no breath of wind in the face; the car hangs always vertically from the envelope. It is only when you touch earth again that you realize your speed, for at the moment that the car stops you feel the wind; and if it be a strong wind your repose and quietude are rudely dispelled, and your balloon, caught by the wind, heels over and drags you along the ground.

There is no sensation of height and none of giddiness. At a great height the earth has a concave appearance, but as there is no wall or line from you to the ground the ordinary sensation

of looking down a cliff is quite absent. At any considerable height also you are so far away from the ground that even if you are travelling at a very great speed it is difficult to see that you are moving at all. It is the same when you are in an express train and your eyes are fixed on a distant part of the landscape; so slowly does the scene change that relatively to the swift passage of nearer objects it appears to be going in the opposite direction to them and in the same direction as the train. Looking down from a balloon it is necessary to take a careful observation of the end of the trail-rope hanging free in the air and watch its slow passage across the map-like country thousands of feet below in order to note the speed.

The extent of the views obtained from a balloon is only limited by the amount of haze or mist in the atmosphere. To a man standing on the seashore the horizon is $3\frac{1}{4}$ miles distant. A flag on a mast 45 feet high and 12 miles distant appears to be on the edge of the horizon. The following table shows the extent of the balloonist's vision:—

Height in Feet.	Distance of Horizon
500.....	30 miles.
1000.....	42 "
2000.....	$59\frac{1}{2}$ "
3000.....	$72\frac{1}{2}$ "
4000.....	$83\frac{3}{4}$ "
5000.....	$93\frac{1}{2}$ "
1 mile.....	96 "

At the height of one mile, in perfectly clear weather, the

balloonist can see 96 miles in any direction. Theoretically, the top of the Alps could be seen from an elevation of 10,000 feet over London. But the air is never so clear as to give such extensive vision. Balloonists over London, however, frequently see the sea.

As the balloonist reaches the higher altitudes, the sky becomes of a deeper blue, and the sun appears like a glaring bright disc on a dark background. Beautiful phenomena are seen by the balloonist. Halos round the sun and moon, rainbows, "glories," or "aureoles"—the coloured rings seen round the shadow cast by the balloon on the clouds—and splendid seas of rolling cloud above and below, reward his enterprise.

But the scenery beheld by the balloonist is an inexhaustible subject. No two voyages are like one another. Quoting from my own description in the *Daily Graphic* of a night ascent from London:—

"For some moments our eyes were riveted on the Crystal Palace, where our friends were now watching us, some of them probably feeling anxious on our behalf. Soon the lights of the Crystal Palace could not be distinguished from the myriad lights stretching away on all sides to the horizon. The lights of London's 150 square miles were displayed below us, infinite in degrees of colour, brilliance, and arrangement. Overhead the stars completed the picture. It was as if we were poised in centre of a vast illuminated globe, whose dark sides were frosted with silver and gold, the roof glittering with lights of peculiar beauty, and adorned with the crescent moon, now hanging over the southwestern horizon."

Over Essex at night the silence was broken only by the barking of dogs and the occasional whistle and rattle of a train. Suddenly a voice hailed us out of the darkness, sounding very near. We had descended near the earth without knowing it, and quickly we shouted, "Where are we?"

"Going towards Dunmow," came the instant reply.

Later on, as we were over the North Sea, crossing 360 miles of it: "At ten minutes to one we became aware of a sudden change in the conditions around us. As if by magic, summoned to appear out of the void in all directions, at a great distance from us, but about the same level, a great number of small, white, fluffy clouds appeared. The circle was complete. It seemed as if the demonstration must be intended for us. Then we became aware that similar clouds were forming another ring nearer to us. Quite motionless in relation to ourselves these weird shapes remained. They were travelling in the same wind. As for our progress, no sense of motion was perceptible. Not a tremor of the car, not a breath of wind, yet we were going at thirty-five miles an hour."

In another voyage we crossed the sea by day:—

"Sea everywhere, and no land in sight. The tens of millions of waves looked very diminutive, but crystal clear, and reflected from their facets every degree of grey and green, light and shadow. The sea was not rough, but the tops of an infinite number of waves were broken to snow-white foam. As we descended nearer to it the incessant murmur of the commotion of waters reached us—a sound of unique quality and wonderful sweetness."

Dawn in cloudland is always impressive:—

“At five o’clock the light was strong enough to make a faint shadow. The balloon had fallen to 4500 feet. The cloud scenery now began to bestir itself. As if for our sole benefit, it commenced a series of wonderful groupings. Across the north-east a straight row of weird and fantastic shapes appeared, black as ink against the lightening sky. They resembled gigantic trees rearing themselves from a flat land covered with white mist. These grotesque shapes appeared to be the same clouds that half-an-hour before had passed slowly below us, then appearing indefinite and fleecy.

“The dawn grew nearer, and a red tinge appeared behind the row of cloud-trees, which became blacker and more sharply defined. A beautiful green hue appeared above the red. To the south the clouds were bluish-grey. The stars were still very brilliant.

“Almost suddenly, at about six o’clock, the row of strange trees lifted up to a higher level. The balloon’s altitude remained the same. Imperceptibly the tree-clouds disappeared, and a series of mysterious and ever-changing clouds took their place. One slate-grey, ponderous-looking mass occupied a giant’s share of the northern sky slightly below us, but with its topmost peaks and domes far above our level.

“It is impossible to give any idea of the immensity and variety of these changing scenes. Nothing like them could be seen from the ground. In the south a limitless stretch of cloud-peaks look like Switzerland moulded in snow. The impression of distance conveyed by it was wonderful, and probably our view extended to 150 miles or more of cloud.”

Infinite is the variety of cloudland! Here is another dawn:—

“Across the light in the east, regiments of vapoury figures slowly stalked. It is easy to imagine that these grotesque shapes were inhabited by spirits akin to their weird forms. There was strange commotion in the field of grey fog. Wisps of thin cloud would suddenly rise here and there, and as the light increased the cloud-shapes became better defined. Never at rest in the general movement eastward, varying currents of air carried some portions of the cloud area faster than others. There were other movements of irregular surfaces up and down. The woolly hillocks passed and repassed each other, rose and fell before each other, and, against the background of the lightening sky, they appeared like small moving pasteboard targets in a shooting-saloon, only white and soft-edged like frisking lambs.”

Passing over Germany at night:—

“At a distance villages and towns were mere blotches of milky light in the darkness. As we approached one it would slowly grow, the blur resolving itself into a group of tiny points of light, becoming larger and larger, and developing in character every minute. In the case of a large town the effect was very striking. What had appeared a small blur of light would extend until it covered half the visible area below with lights of every possible shade of yellow and white and the bluish-white of electric lamps.

“Later the country seemed to be almost deserted. Only occasionally could we hear the barking of a dog or the roar of a train. When above the clouds silence seemed absolute. We

appeared to be going in the same direction as the clouds below, only faster than they. It was a curious race between the balloon and the patches of vapour, and the balloon never failed to overtake and to pass any point in the diversified field of grey upon which we set our eyes. At rare intervals through an interstice in the clouds we caught a glimpse of a cottage light."

In a night voyage over England a remarkable experience befell us, the balloon sailing near the ground and disturbing a vast number of pheasants, partridges, and water-fowl, whose remarkable, shrill cries and the rushing of myriad wings amounted to a deafening volume of sound. Dogs barked, and we heard the tinkling of sheep-bells and the trampling of horses over turf. Coveys of partridges created sudden disturbances as we approached. We heard the peewit's shrill calls and the alarmed twitter of many small birds. It was interesting to observe that the perfectly silent passage across the sky of our balloon was sometimes sufficient to arouse these sleepers. We became enveloped in thick fog. We could not see any habitation, but once the sound of a man's cough reached us, and we constantly heard small birds twittering and the calls of water fowl.

It is impossible to describe the innumerable small entertainments, and the constant anxiety of a night in the air under these circumstances. Fog is the balloonist's particular enemy, and although we were fortunately not imperilled by it, it certainly caused us much anxiety. Fog all around, above and below, and suddenly, close to one's elbow, as it seems, the bell of a church clock chimes three o'clock. There is the constant

inquiry, "Is our course the same?" and the eager watching for a momentary clearing of the fog in which to take an observation.

Aerial travellers will be out in all weathers. Here is the description of our cold night over Russia:—

"We were huddled up in corners, keeping our electric lamp ready for reading the aneroid, the glass of which was coated with ice, which had frequently to be rubbed off. Our caps and coats were thick with snow, and altogether a colder and gloomier aspect of affairs could scarcely be imagined except in the Arctic Circle. Steadily we climbed to 11,000, 12,000, 13,000, 14,000 feet, each thousand taking no more than ten minutes to accomplish. As steadily the thermometer went down to 5° Fahr. Fifteen thousand, 16,000 feet high, and the thermometer down to zero, beyond which point it would not indicate, for so great a cold had not entered into our calculations.

"Even at this height the snow was falling. Through 16,000 feet we had forced our way upwards against it, in spite of our increasing burden. Less rapidly the aneroid indicates that we crept up to 17,000 feet, and 200 feet above that—17,200 feet—and the temperature probably at 2° Fahr. below zero.

"I think we were all worn out by the exposure and the hardships, and it is likely enough that the rarity of the air at this altitude of over three miles—higher than the highest mountain in Europe—may have distressed us a little. It was easy to imagine strange forms in the blackness, out of which streamed cold, light particles touching our faces and clinging to our clothes: there a gigantic monstrous shape floating by;

below, a dimly seen palace, and a woman descending its marble steps, finding her way by the light of a lamp."

Entirely different is aeroplaning. My own first flights were as a passenger towards the end of 1910 at Brooklands, where I took my first photograph from an aeroplane, and at Hendon. My first cross-country flight was on a "Bristol" military biplane under the care of Archibald Low, who took me from Amesbury, Wiltshire, over hill and dale and woods and pastures—and Stonehenge!

The circumstances that placed one of Great Britain's first aviation centres in sight of Stonehenge, that mysterious monument of ancient times, must surely have been something more than chance. So dramatic and romantic an encounter between the ghostly past and the mightiest and most modern of scientific miracles might well have been arranged by a supreme artist weaving strange pictures in the loom of time. We sped swiftly through the air some hundreds of feet directly over Stonehenge. Behind me the roar of a mighty Gnome engine that impelled this great machine; around me the buoyant wings of the aeroplane obeying the lightest touch of the hand of the pilot in front; and, tearing past like a gale of wind, the frosty air that held us up yet seemed to strive its utmost to bar our way. Towards the end of the journey Low stopped the engine and brought the aeroplane down in a steep vol-plane to a lower altitude, approaching a flock of sheep, who scattered wildly. Then he started the engine again, and we resumed skimming along a few feet from the ground.

In an aeroplane there is no sense of height except that de-

duced from the apparent size of familiar objects. The rush of wind is ever on the face, and in cold weather it is very cold indeed. But always it is exhilarating.

It is as easy to learn to fly as to learn to ride a bicycle; but as a blunder in a flying machine is apt to result in broken wood and wire, so it is necessary in learning to fly to proceed by comparatively cautious steps. In learning to ride a bicycle the pupil is almost from the beginning entrusted with the sole command of the machine. He cannot easily damage it or seriously hurt himself. The vast majority of cyclists have become proficient riders without doing any damages; and this can now be said also of the great majority of flight pupils. Take my own case, and it is typical of that of the average pupil. I learned to fly, and in the process I did not break wood or strain a wire up to the time of obtaining my pilot's certificate—I was, by the way, the fifth Englishman to do so under the new stringent conditions imposed in 1911 by the International Aeronautical Federation, and I am No. 70 on the list of British aeroplane pilots—I never did more damage than could have been repaired for five shillings, and this was not due to a beginner's blunder, but was simply what a golfer would call the "fortune of the green": it was done in a bad landing brought about by my encountering thick fog, in which I flew perilously near to some telegraph wires and was obliged to make a quick descent. I learned to fly on a "Bristol" biplane at the school near Amesbury or Salisbury Plain.

Whether ballooning is a very valuable preparative for mechanical flight I am unable to say. It cannot be denied that

it has some value, and I found that the idea of leaving Mother Earth for an excursion into the air had, of itself, no terrors. That many people are appalled at the prospect is undeniable, and it is a factor that we must take into account. But it is not reasonable; and people who would not on any inducement make a balloon or an aeroplane ascent have shown themselves indifferent to far greater risks on *terra firma*.

Flying has been compared to many things; but, in truth, no comparison is good. Let me, however, correct one or two common, but false, notions concerning it. There is, as I have said, no sense of travelling at a great height: there is not the slightest danger of giddiness. To me this gave no surprise; for, as every balloonist knows, it matters not whether he look down from twenty or from two thousand feet the sensation of height is absent. To take my own case, I cannot look down a hundred-feet precipice for many seconds without being compelled to turn back from the edge, but I can look down from a balloon that is 10,000 feet above the ground for half-an-hour at a stretch without feeling a qualm. And I can guarantee the same immunity to my readers.

In an aeroplane flight, when the engine starts, the noise, vibration, and sense of speed as the machine shoots forward over the ground are certainly tremendous. Some people find them at first somewhat unnerving, but even nervous people soon get used to them. It is almost impossible to perceive the exact moment that the machine leaves the ground; only there is, with the increased speed along the ground and when flying, a rapid diminution of the noise, a swift decrease of the vibration, until

the machine is simply gliding with perfect smoothness and there is nothing to inform you of the speed except the rush of wind upon the face. For as you rise from the ground it does not continue to rush beneath you, and the higher you get the slower do you appear to be moving. As to one's sensations in full flight, there is the growl of the engine, which, with use, soon becomes unnoticeable, and with this there is the steady rush of air over the planes giving forth its own peculiar music. Sometimes the machine rocks slightly laterally and in the path of flight, but the movements are as a rule very small and are corrected as soon as they occur. Occasionally, too, the machine will seem to sink slightly and suddenly in what is known as "a hole in the wind"; and at times one hears a slight thumping as with a muffled mallet on the planes, caused by the buffeting of the air.

The pupil's lessons begin with passenger flights, followed by instructional flights during which he is allowed to place a hand upon the lever in order to feel the movements and to understand better what the pilot is doing. When he has obtained experience the time approaches for him to make his first solo ascent, which, as can readily be imagined, is a great event in his life. Having made his first solo flight, no matter how short, or how confused his feelings, the battle is more than half over. His second flight is infinitely easier, and with the third and fourth he feels quite at home in the air. From that point his progress is rapid, for there is nothing in the least difficult in the control of an aeroplane except in high wind. The ground-work was laid while the instructor was deeply imbuing him with

the idea of flying and compelling him to realise, so as to make a second nature or an instinct of making all his movements very gently and nicely but also as quickly as required.

After my sixth or seventh flight with the machine in my sole charge I was ready to fly for my certificate. This, perhaps, would have been "pressing the game" somewhat; and, as a matter of fact, it was not until I had made eleven solo flights, including the first two straight hops which are scarcely worthy of the name, that I was put through my tests. These tests required that the pupil shall make two separate flights, each consisting of five complete figures of eight; that in one of them he should attain an altitude of at least 50 metres (167 feet); and that from each he should land with the motor cut off and come to a halt within fifty yards of a spot previously designated. Two of us pupils were flying for our "brevets" on the first test, and as my fellow pupil had made two of his figures of eight before I was sent up, it was necessary to fly high in order not to embarrass him. So that in my first test I flew at a height of 700 or 800 feet. The second test took place three days later, namely, on the 23rd of April 1911. It had been windy all day, but towards sunset the wind fell to about ten miles an hour, and I declared my intention to make the attempt, the official of the Royal Aero Club being present and everything ready. As it may give the reader an idea of what flying in difficult conditions is like, perhaps I may be pardoned for describing at length my final test flight.

I had no sooner left the ground than I realized that the wind was stronger than it had seemed. As a matter of fact the wind

was rapidly increasing. Rising against the wind just after crossing between the two mark-flags the machine almost stopped in its career. It reared up considerably and rolled from side to side, calling for quickness and strength to keep it in even flight. I soon found that going against the wind the speed of the machine, judged from familiar landmarks below me, was not more than 6 or 10 miles per hour; the wind, therefore, was about 30 miles per hour; also it was clear that I was to have a severe tussle. But finding that I could manage to fly I kept on, taking care to go far beyond the mark-flag before attempting to turn; for immediately the machine had its side, and then its tail to the wind it would be driven along at a great pace. This, of course, proved to be the case, and it was only by care that I managed to effect the turn in time to cross between the flags again. Also, with a following wind the machine had a strong tendency to come down to the ground. This, by the way, would not be the case were wind to blow in an even current of uniform velocity; nor would a machine tend to plunge upwards when flying against the wind were this the case. But, as the reader knows, all wind is made up of alternations of small and comparatively high velocity, the variation in most cases amounting to 30 per cent of the average velocity; and this factor, taken in conjunction with the inertia of the flying machine, accounts for the phenomena I have mentioned, as also it accounts for at least 80 per cent of the difficulties and dangers, such as they are, of mechanical flight. But, further, I found naturally that in going with the wind the speed relatively to the earth was at least 70 miles per hour, and it required considerable

strength and quickness to keep her on her course. At the same time, whether flying with this strong wind abeam, or ahead, or behind, the sensation of wind on my face was unvarying, so that if I shut my eyes I could not have perceived whether I was flying in one direction or another relatively to the wind.

After completing one figure of eight, taking care not to bank the machine up in turning with the wind from the outside of the turn, but taking advantage of having the wind on the inside of the turn when on the opposite side of the circle to bank the machine up considerably and so to some extent prevent the side-drifting, I decided to continue; and I was the more desirous of continuing because not only is every pupil anxious to win his certificate, but I saw my instructors, Jullerot and Collyns Pizey, together with the other pupils standing between the mark-flags, clapping their hands in encouragement every time I crossed. One figure eight was like another save in detail. I endeavoured to change my course somewhat and find out if it were possible to avoid certain difficult spots, but in each case it was necessary to make a wide detour against the wind in order to gain room enough to turn, and at the end of the eight away from the wind I was each time drifted half a mile or so out of my way. In flying against the wind I increased my altitude as much as possible in order to allow for the downward course with the wind. In the fourth eight I experienced a "side-slip." In turning to the right with the wind on the outside, although careful not to bank the machine up on the left, the wind, nevertheless, caught it and threw the left wing up at such an angle that the machine began to slide downwards to the right. Good teaching came

to my rescue. I turned the machine hard into the wind, *i.e.* to the left, and corrected the inclination by a very pronounced movement with the ailerons. After a moment my efforts had the desired result: the slip was checked with still fifty feet or so to spare, and the machine righted itself.

The flight lasted 25 minutes, whereas in ordinary conditions the trial can be got into 16 minutes with a machine of the type I was using. But I had won my brevet, and had gained experience of flying in wind which would certainly prove valuable. Also, I had gained a confidence in the machine and in flying which were well worth the trouble.

Wilbur Wright described the sensation of aviation as "something more exhilarating than motoring, easier and smoother, with a movement of added dimension.

"At a height of 100 feet you feel hardly any motion at all, except for the wind which strikes your face. If you did not take the precaution to fasten your hat before starting you have probably lost it by this time. . . . You make a very short turn, yet you do not feel the sensation of being thrown from your seat, so often experienced in automobile and railway travel.

"The operator stops the motor while still in the air. . . . The motor close beside you kept up an almost deafening roar during the whole flight, yet in your excitement you did not notice it till it stopped."

Frantz Reichel, writing in the *Figaro*, recorded his impressions in the following manner:—

"I have known to-day a magnificent intoxication. I have learned how it feels to be a bird. I have flown. Yes, I have flown!

"I am still astonished at it; still deeply moved. For nearly an hour I have lived that daring dream vainly pursued through all the ages by audacious man.

"When we started there was a sudden impression of a plunge into space which gave me a *coup a l'estomac*. Then suddenly it was all very smooth, a cradling amid the thunder of the motor. I did my utmost to see well, to feel everything radiant, but not daring to move or even to stir.

"We advanced towards the horizon, the dunes, the hills, the fir-trees, in a giddy gliding. It was strange and exquisite. The air flowed upon me caressingly. I could keep my eyes wide open; the air bathed me but did not whip me. This was the first impression a mile from the starting-place, above a magnificent carpet of heather.

"I hung out my head and looked at the crowds below. They were waving handkerchiefs. Gently, with my elbow firmly fixed to my side, I moved my arm in a mechanical manner, like a dummy. I let go of the iron bar by which I was supporting myself. It was quite safe to move, and I risked more and more.

"The sun is sinking, we are flying in the twilight. From the ground appears and descends a slight mist, which covers the big glens with a white carpet. It is the doubtful and suspicious hour of the day.

"The night has come. It is getting dark, and the moon is rising. Silence reigns over the woods and fields. I cannot believe that it is I who am flying in the night. The sensation is so magnificent that I long to pass several hours in such a manner.

"Night is now complete. Cyclists, peasants, and chauffeurs have lighted their lanterns or their torches. And this illumination pierces through the darkness. But we fly on, chasing our shadow, which the moon throws before us.

"If I had known I should have brought a pencil and a writing-block with me, and have recorded my impressions. One is able to write much more comfortably in an aeroplane than in a train or motor-car."

Finally, Frank Hedges Butler, the founder of the Royal Aero Club, very happily describes the sensation as that of skating on very clear ice and seeing with perfect clearness the bottom of the lake.

THE ARMY OF YOUTH

HOW THE BOYS WERE TRAINED IN ENGLAND

IN A corner room of the Hotel Cecil, with windows whence we gained a superb vista of the Thames flowing beneath its many bridges, sat a small man talking quietly of the difficulties that had arisen in his work. He was a Scotsman, with that definite accent which is to be found in all positions where organising ability opens the way to supremacy. When the war broke out he was known only in shipping circles, but the nation needed his services, and in one rapid step he became Secretary of State for Air, which marks a new era in Government and civilisation alike. Lord Weir was the administrative head of the Royal Air Force, and when one read at the breakfast-table one morning that youth had taken wings and given the citizens of Frankfort a bad half-hour in the dead of night, then one knew that a part of his organization had been set in motion over the proud soil of the German fatherland.

The blow on Frankfort, however, is the final act of an immense machine whose ramifications I have been permitted to follow. The alert, laughing-eyed young man with wings on his left breast, whom we see in hotels and other public places, so cherubic that we are apt to think the wings have been mis-

From Training the Airman

placed, is the product of a wonderful mushroom organization, of a system that combines psychology with science and takes earth and air into its domain. There is but six months' distance between the schoolboy who, in the fifth form, familiarized himself with quadratic equations and the debonair young gentleman whose knowledge of aerial navigation, twelve-cylinder engines, and absence of the first sense have enabled him to travel 300 miles through the night at an altitude of 5000 feet and drop high-sounding visiting cards on cowering hosts. It is the record of six months of concentrated pressure such as would burst any head not possessing the resilience and ardour of youth. Let us live that six months and follow him from the day he leaves a tearful mother until the proud hour that he monopolises a line of type in an R. A. F. communique.

The future airman may be nearly eighteen or thirty when he begins his career; if near the latter age he can pride himself upon being a fine specimen of preserved youth. The medical test is essentially severe, for fitness is the first requisite of the man who would scorn earth and sever the air at a hundred miles an hour. He may be slightly lame, for walking is not a strict test, but he must possess perfect sight, strong lungs, a sense of balance, quick hearing, and above all, indomitable pluck. Indeed, he must have acquired the negation of fear which only youth can accomplish by indifference. The Royal Air Force is no place for the sensitive egoist. But the strictly medical test is only one hurdle of many to be cleared. The acutest test may be classed as a psychological one. In the rooms of a house in Hampstead, remotely associated with medi-

cal matters in that it was once the home of a millionaire pill-maker, I watched the cadets as they appeared in turn before the doctors. They were fresh-cheeked schoolboys, with curly hair and clear eyes. Their bodies had the suppleness and rhythmical grace of youth which make *embonpoint* at forty seem a miracle of degeneracy. The resisting power of their lungs was tested by a method which threatened slow suffocation, they were made thoroughly dizzy, and yet trod a line with perfection that would have inspired rapture in the breasts of alcoholic performers. They were jerked and expected to keep their feet, they were subjected to sudden noises and expected to show no surprise, and they were called upon to perform balancing acts that aroused the shade of Blondin.

The youngster I watched was eighteen, with the supple muscles of a panther; he held his breath until the examining officer began to think of writing to the *Lancet*. He did not flinch when a sudden noise made us jump, and the tell-tale turning fork held outright in his hand did not make even "the little noiseless noise" of which Keats spoke. He was made to tread a straight and narrow line,—no easy task when keen eyes are watching one and the nerves are strained by self-consciousness; this accomplished, progress must be made backwards, and the candidate must prove a birdlike ability to stand motionless upon one leg, as though he had been metamorphosised into a stork. Then follows a quaint test that might have come from the Spanish Inquisition. The victim sits in a chair which rapidly revolves. At a given signal he must jump out of it and walk unwaveringly along a narrow line—it is like the bridge of hair

along which the good Mohammedan crosses to Paradise. A specialist with the eye of an eagle and the mouth of a barrister looked up the candidate's nose, down his mouth, and into his ears. He insisted upon calling his patient "Laddie," and said it with such fatherly affection that one began to comprehend the splendid spirit that had made him forsake the West-end practice worth several thousands a year to become a colonel in a bare room. One could see by the manner in which he asked for the repetition of unsatisfactory tests how it grieved him to disappoint the eager spirit of a boy. He was determined that shyness and nervousness should be banished from his presence.

My young friend, safely out of the specialist's room, had not finished with the lynx-eyed examiners. He was led into a dark chamber where oculists had laid cunning devices to prove that he could not see straight. Little holes, lights, letters, and needles assailed the candidate with doubt. Clear vision seemed as impossible there as in a theological conference—only those of great faith could possibly survive the temptations assailing the senses. But our young candidate was determined to fly, and overcoming all provocation to squint, he passed out, his flag flying. He had now to pass the final review of the medical assessors, but here again pulse and blood pressure, determined by a black scarf and a chronometer that would have fired the tortured imagination of Edgar Allan Poe, were regular and uninterrupted even by the issue at stake. With a triumphant gleam in his eye he marched out, and his fresh young spirit was seized upon by a sergeant. Two months of

strict discipline are now before him, in which his feet and head will act under the stentorian tones of those weather-beaten backbones of the Army. But the candidate has a little breathing space ere he receives his kit and is sent on to the Cadet Brigade for the first stage of his training. He uses it for the sending of a triumphant telegram home, in which he mingles flamboyant exultation with judicious pleading for cash; and, although his income is now one and sixpence per day, with uniform, messing, and quarters found, what stern parent could suppress prodigality on learning that his flawless youngster has become a fledgling, a choice spirit of the air?

An open, wind-swept place, with low-roofed hangars camouflaged with streaks of paint, a broad strip of tarmac on which various aeroplanes are receiving the solicitous attention of greasy-coated, shock-headed mechanics, and a few debonair young gentlemen in fur-lined helmets and glossy leather boots—that is the sight which quickens the cadet's pulse. He has arrived at the place where he will leave the earth. It is his jumping-off ground. Man's ambition and the progress of science have brought the cadet to his exalted moment.

At last he is seated in his machine. It has a dual control, by which means he can watch his instructor and copy his actions. They are wheeled off the tarmac, the engine whirrs with anticipatory delight. "Contact, sir!" rings out, and they are off. The ground hurries by, and the cadet takes a deep breath; the edge of the aerodrome is perilously near. He prays that the farmhouse in front may dissolve, when lo! he is gliding over its chimney-pots. That is the first surprise of flying

—the realisation that one has left the earth. Sight, and not feeling, informs one; the rising into space is an apparently motionless transition. Then comes the second revelation: there is little sense of speed. The earth below seems winding away slowly; the fields huddle themselves closer.

The cadet is now holding his joystick; for two minutes he has flown the machine, and the fact must be gently broken to him lest the ease and surprise should shock him into sudden failure. So he hears a voice in his ear, surprisingly near, and loud above the roar of the engine. Down the telephone connecting his head with that of the instructor's comes the voice of assurance. The cadet's heart leaps with great joy. He has done it. The dream of man for ages has been fulfilled. And down there the silly old earth goes reeling by with enfeebled age—at one revolution per twenty-four hours!

Such is the beginning, but the end is far off. After several trips dual, he must fly solo, and then his pride will be lowered. Once more he must bridle his head with the telephone and be told that he's contracted bad habits, and is asking for a fall. So his career and education proceeds, with hours of single joy and periods of dual control. At the end of six weeks, if he has a sense of balance and a great store of pluck, he will be able to loop the loop, nose-dive, and half-roll. Then he gets his wings, opens his chest another two inches—and a banking account at Cox & Co.'s.

The hour of his great accomplishment marks the beginning of that fine humility characteristic of the airman. They are devout lads, these. They know how near Death is, and al-

though they laugh in his face with the insolence of youth, yet they know the significance of what they do, of what may happen. It is told of the late Captain Ball that always before flying he could be seen in his pilot's seat, eyes shut, praying silently for a few minutes; a moment later he poured forth an avalanche of oaths upon the laggard mechanics ere he leapt skywards. It was characteristic of the airman's temperament. There is something more than a mere custom in the fact that they measure their lives by hours. "How long were you at the Front?" I asked a young major with three decorations. "Four hundred hours," he replied, and I learned that that was a very long life. "How long have you been flying?" I asked a marvellous stunter when he alighted. "Nearly two hundred hours now," he said. They only live when they fly, and scorn time passed upon earth.

At the cadet's training depot station, where he first experiences flight, the gunnery learned at the Armament School is put into practice. True, the target is not exciting, a gleaming pond is whipped into showers of protest by constant bombardment from the air. Once, the story is told, a young airman, in the glory of the moment, kept on firing long after he had flown over the pond, and an inoffensive cow was put out of action. The cow, quite dead, at least represented a carcass, and for hours afterwards lead was pumped into her, until, as an airman announced, "the milk ran out." There was something so ludicrous in the last remark that we all rocked with laughter; we were sorry for the cow, of course—but the humour was delicious.

The young airman will later have an opportunity of becoming an expert. The instructors are drawn from experienced pilots who have returned from the battle front with the latest manœuvres. He will have learned to throw his machine about, to test his instinct for balance by wilfully upsetting himself, to make forced landings in confined spaces, to alight almost in the length of his own machine with the delicacy and poise of a ballerina.

But supposing he does not take kindly to flight, that he crashes and is turned out of the aerodrome? Even then he will have a second chance, after filling in a fearful paper wherein he confesses to his favourite poet or his hatred of solitude. And although psychology is not yet sufficiently advanced to quite justify its presence as a legitimate test in a medical research department, the fact remains that the pilot gets a second chance under instructors who may prove more congenial or clearer in their methods. It took several months to fetch those wings to the surface, and now infinite care is taken to get them well spread in flight; and whoever gained heaven with such ease before?

The boy who stood stripped in the doctor's room a few months previously is now resplendent in uniform, with those white wings on the breast which represent an increase of dignity and income. He can fly—he has learned the thrill of seeing the silver side of the cloud lining of which he was told by encouraging uncles from boyhood.

FIGHTING THE FLYING CIRCUS

Captain Eddie Rickenbacker, "American Ace of Aces" here tells his own story. Mr. Rickenbacker has a record of twenty-five victories in the Great War.—*Editor.*

I

INTRODUCING "ARCHY"

AFTER days of schooling and nights of anticipation, I woke up one morning to find my dreams come true. Major Raoul Lufbery, the most famous of our American flyers, and the Commanding Officer of our group, announced that a flight would take off after breakfast for a look at the war across the German lines. He himself was to lead the flight. The patrol was to be over enemy territory in the Champagne sector.

"Who is to go?" was the thought in every pilot's mind, as we all stood by in more or less unconcealed eagerness. None of us had as yet caught a glimpse of our future arenas. We all had vague ideas of the several kinds of surprises in store for us over Hun lines and every one of us was keen to get into it.

Major Lufbery looked us over without saying much. Luf was very quiet in manner and very droll when he wanted to be. He had seen almost four years of service with the French Air Service and in the Lafayette Escadrille and had shot down

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seventeen Hun aeroplanes before the American Air Service began active work at the front. Every one of us idolized Lufbery.

"Rick!" said the Major casually, "you and Campbell be ready to leave at 8.15."

I tried to appear nonchalant as I replied, "Yes, sir."

Douglas Campbell put up a much better face than I did. The other boys crowded around and presented us with good advice, such as "Look out for Archy, mind," and one thoughtful fellow kindly cautioned me to crash in our lines if the Huns got me, so that he could personally put a cross over my grave.

That memorable morning was the 6th day of March, 1918. I had joined the Hat-in-the-Ring Squadron just two days before at Villeneuve. We were then some twenty miles behind the lines and were well installed on an old aerodrome that had been used previously by several French Aero Squadrons. This expedition was to be the first essay over the lines by a made-in-America Squadron.

Sharp upon eight o'clock I walked into the 94th Squadron hangar and called my mechanics. We were flying the French single-seater Nieuport with a rotary motor, and every machine was kept in the pink of condition at all times. Nevertheless I wanted to make doubly sure that everything was right on this occasion, for Major Lufbery had a reputation for punctuality.

"Henry," I demanded, "how is my Number 1?"

"Best machine in the shop, sir," the mechanic replied. "She's

been all tuned up since you came in last night and there's not a scratch on her."

"There will be when you see her again," I muttered. "Run her out on the field and warm her up."

I left the hanger and looked down the road for the Major. Campbell was already in his flying clothes. I wanted to be ready on the exact minute, but not too soon. So I lit a cigarette and kept an eye on the Major's door. All the boys came sauntering up, trying to look as though they were not half mad with envy over my chance to get my head blown off first. They wished me well, they said, but they would like to know what to do with my personal effects.

When Major Lufbery entered the hangar he found us ready for him. It takes about ten seconds to step into your Teddy-Bear suit, slip a flying helmet over your head and snap on the glasses. Campbell and I climbed into our Nieuports. The Major gave a few instructions to Lieutenant Campbell, then came over to me. I felt like a man in the chair when the dentist approaches. Of course I listened politely to his parting words, but the only thing that appealed to me in his discourse was the order to stick close to him and keep formation. He did not have to repeat that order. Never before did I realize how seductively cold death beckons a pilot towards his first trip over enemy lines.

Lufbery ran up his motor for a moment, then took off. Campbell followed upon his heels and then I opened up my throttle. I cast a last, longing glance at the familiar flying field as I felt my tail go up, the wheels began to skim the



Capt. H. E. Pickenbaker

ground and with the wind in my teeth I pulled her up and headed after Campbell. What a devil of a hurry they were in! I knew I should never catch up with them.

The beautiful ruins of Rheims soon spread beneath my right wing. My machine was certainly not as fast as either Lufbery's or Campbell's. I continued to hang back far behind my formation. The lines of the enemy were approaching and Lufbery, my only salvation, as it appeared to me, was at least a mile ahead of me.

I shall believe to my dying day that Major Lufbery knew my thoughts at that moment. For just as I felt that he had forgotten all about me he suddenly made a virage and took up a position a few hundred feet from me, as much as to say, "Don't worry, my boy, I have an eye on you." Again and again this occurred.

It was with great difficulty that I tried to perform the same maneuvers that Major Lufbery executed with such great ease. I grew somewhat interested with my attempts to imitate his example in preserving our little flight formation, and this occupation of keeping within shouting distance of my companions made me forget entirely that old Mother Earth was some 15,000 feet underneath me and the trenches about the same distance ahead. The bitter, numbing cold which always prevails at these high altitudes was of course by this time an old and familiar experience to me.

We had been sailing along at this dizzy height for some thirty minutes between Rheims and the Argonne Woods when it occurred to me to look below at the landscape. And such

a spectacle spread itself out before my eyes when I at last did look over the side of my little office!

The trenches in this sector were quite old and had remained in practically the same position for three years of warfare. To my inexperienced view there appeared to be nothing below me but old battered trenches, trench works and billions of shell holes which had dug up the whole surface of the earth for four or five miles on either side of me. Not a tree, not a fence, no sign of familiar occupation of mankind, nothing but a chaos of ruin and desolation. The awfulness of the thing was truly appalling.

Perhaps this feeling got the best of me for a moment. I don't know of what Campbell was thinking and I suppose Major Lufbery was far too accustomed to the situation to give a thought to it.

But just when I had gained enough equilibrium of mind to keep my place in formation and at the same time take an interest in the battlefields below me, I began to feel a terrible realization that seasickness had overcome me. A stiff wind was blowing all this time and no ship upon the high seas ever rolled and pitched more than my Baby Nieuport did this 15,000 feet above No Man's Land, while I was attempting to follow Major Lufbery's evolutions and maneuvers.

I didn't want to confess even to myself that I could get sick in the air. This was what would be expected from a brand new aviator on his first trip over the lines. It would be wonderfully amusing to Lufbery and the rest of the boys in the Squadron when I got back to the field—if I ever did

—to advise me to take along a bottle of medicine next time I tried to fly. I grew cold with the thought of it. Then I set my teeth and prayed that I might fight it off. I determined to look straight ahead and fly straight ahead and to concentrate my whole mind on the task of sticking it out, no matter how I felt.

I had hardly got control of myself when I was horribly startled by an explosion which seemed only a few feet in my rear. I didn't even have time to look around, for at the same instant the concussion caught my plane and I began to roll and toss much worse than I had ever realized was possible. The very terror of my situation drove away all thoughts of sickness. In the midst of it several more shocks tipped my machine and repeated sounds of nearby explosions smote my ears. No matter what happened, I must look around to see what awful fate was overtaking me.

All that I could see were four or five black puffs of smoke some distance behind and below my tail.

I knew what they were right enough. They were "Archy"! They were eighteen-pound shells of shrapnel which were being fired at me by the Germans. And the battery which were firing them was only too well known to me. We had all been told about the most accurate battery that allied aviators had met in this sector. It was situated just outside of the town of Suippe. And there was Suippe down there just under my left wing. A mile north of Suippe was the exact location of this famous shooting battery. I looked down and picked it out quite clearly. And I knew they could see me and were

seeing me much more plainly than I was seeing them. And probably they had quite a few more of those shells on hand which they were contemplating popping up at me.

I shall never forget how scared I was and how enraged I felt at the old pilots at home, who pretended to like the Archies. The latter were bursting all around me again and were terribly close and I felt a vengeful desire to get home just once more in order to take it out on those blase pilots, who had been telling us newcomers that anti-aircraft guns were a joke and never did any damage. They used to count up the cost of each shell at five or ten dollars apiece and then figure that they had cost the German Government about a million dollars for their morning's amusement in flying over the Archy batteries, with never a hit. And I had been fool enough to believe them. Any one of those shells might happen to hit me just as well as happen to burst a hundred yards away. It was due entirely to my own good luck, and not at all to those scoffers' silly advice, that one of them hadn't hit me already. I was more indignant with the boys who had been stuffing me with their criminal wit than I was with the Boche gunners who were firing at me.

Never before did I, and never again will I quite so much appreciate the comfort of having a friend near at hand. I suddenly noticed Major Lufbery was alongside me. Almost subconsciously I followed his maneuvers and gradually I began to realize that each maneuver he made was a direct word of encouragement to me. His machine seemed to speak to me, to soothe my feelings, to prove to me that there was no danger so long as I followed its wise leadership.

Little by little my alarm passed away. I began to watch the course of the black puffs behind me. I grew accustomed to the momentary disturbance of the air after each explosion and almost mechanically I met the lift of the machine with the gentle pressure of my joystick, which righted my Nieuport and smoothed its course. And a rush of happiness came over me with the assurance that I was neither going to be sick nor was I any longer in any terror of the bursting shells. By Jove, I had passed through the ordeal! A feeling of elation possessed me as I realized that my long dreamed and long dreaded noviciate was over. At last I knew clear down deep in my own heart that I was all right. I could fly! I could go over enemy lines like the other boys who had seemed so wonderful to me! I forgot entirely my recent fear and terror. Only a deep feeling of satisfaction and gratitude remained that warmed me and delighted me, for not until that moment had I dared to hope that I possessed all the requisite characteristics for a successful war pilot. Though I had feared no enemy, yet I had feared that I myself might be lacking.

This feeling of self-confidence that this first hour over the Suippe battery brought to me is perhaps the most precious memory of my life. For with the sudden banishment of that first mortal fear that had so possessed me came a belief in my own powers that knew no bounds. I loved flying. I had been familiar with motors all my life. Sports of every sort had always appealed to me. The excitement of automobile racing did not compare with what I knew must come with aeroplane fighting in France. The pleasure of shooting down an-

other man was no more attractive to me than the chance of being shot down myself. The whole business of war was ugly to me. But the thought of pitting my experience and confidence against that of German aviators and beating them at their own boasted prowess in air combats had fascinated me. I did not forget my inexperience in shooting. But I knew that could be learned easily enough. What I hungered to ascertain was my ability to withstand the cruelties and horrors of war. If that could be conquered, I knew I could hold my own with any man who ever piloted an aeroplane.

This confidence in myself must have aided me considerably in my learning to fly. After twelve flights in a machine in France, I went aloft for a flight alone. After that first solo flight, I tried several different types of machines with never any feeling of insecurity.

I was floating along through enemy skies in ecstatic contemplation of these thoughts when I suddenly discovered that Major Lufbery was leading us homewards. I glanced at the clock on my dashboard. It was nearly ten o'clock. We had been out almost two hours and our fuel supply must be running low. These fast-flying fighting machines cannot carry a large supply of gasoline and oil, as every pound of weight counts against the speed and climbing powers of the aeroplane.

Gradually we descended as we approached the vicinity of our aerodrome. This lovely section of France, as yet undevastated by war, spread below the wings of our little Nieuports in peaceful contrast to the ugliness that lay behind us. Some snow still filled the hollows as far as the eye could reach,

for a severe storm had raged over this section of the country but a few days before.

We circled once about the field and, shutting off motor, slid gently down into the mud which quickly brought the machines to a full pause. Quickening the speed of the propellers we taxied one by one towards the door of the hangar before which every pilot and mechanic stood awaiting us with open-armed expectancy. They were eager to hear the details of our first flight into enemy territory and to see how two beginners, like themselves, had stood the experience.

Both Campbell and I wore satisfactory countenances of bored indifference. We had had a little flip around over the Hun batteries and it had been most droll seeing the gunners wasting their ammunition. We must have cost the Kaiser a year's income by our little jaunt into his lines. As for enemy aeroplanes, none of them dared to venture up against us. Not a plane was in our vicinity.

Just here Major Lufbery broke into the conversation and asked us particularly what we had seen. I didn't like the sound of his customary little chuckle on this occasion. But we both repeated as easily as we could that we hadn't seen any other aeroplanes in the sky.

"Just what I expected. They are all the same!" was the Major's only comment.

We indignantly asked him what he meant by addressing two expert war pilots in such tones.

"Well," said Lufbery, "one formation of five Spads crossed under us before we passed the lines and another flight of five

Spads went by about fifteen minutes later and you didn't see them, although neither one of them was more than 500 yards away. It was just as well they were not Boches!

"Then there were four German Albatros two miles ahead of us when we turned back and there was another enemy two-seater nearer us than that, at about 5,000 feet above the lines. You ought to look about a bit when you get in enemy lines."

Campbell and I stood aghast, looking at each other. Then I saw he was thinking the same thoughts as I. The Major was ragging us from a sense of duty, to take some of the conceit out of us. But it was only after weeks of experience over the front that we realized how true his statements probably were. No matter how good a flyer the scout may be and no matter how perfect his eyesight is, he must learn to see before he can distinguish objects either on the ground or in air. What is called "vision of the air" can come only from experience and no pilot ever has it upon his first arrival at the front.

Then sauntering over to my machine the Major bucked me up very considerably by blandly inquiring, "How much of that shrapnel did you get, Rick?" I couldn't help laughing at his effort to put me in a heroic picture-frame for the benefit of the boys who were listening. Imagine my horror when he began interestedly poking his finger in one shrapnel hole in the tail; another fragment had gone through the outer edge of the wing and a third had passed directly through both wings not a foot from my body!

The boys told me afterwards that I stayed pale for a good thirty minutes and I believe them, for a week passed before the

Major suggested to me that I again accompany him into the German lines.

II

DOWNING MY FIRST HUN

It will be noticed that my preparation for combat fighting in the air was a gradual one. As I look back upon it now, it seems that I had the rare good fortune to experience almost every variety of danger that can beset the war pilot before I ever fired a shot at an enemy from an aeroplane.

This good fortune is rare, it appears to me. Many a better man than myself has leaped into his stride and begun accumulating victories from his very first flight over the lines. It was a brilliant start for him and his successes brought him instant renown. But he had been living on the cream at the start and was unused to the skim-milk of aviation. One day the cream gave out and the first dose of skim-milk terminated his career.

So despite the weeks and weeks of disappointment that attended my early fighting career, I appreciated even then the enormous benefit that I would reap later from these experiences. I can now most solemnly affirm that had I won my first victory during my first trips over the lines I believe I would never have survived a dozen combats. Every disappointment that came to me brought with it an enduring lesson that repaid me eventually tenfold. If any one of my antagonists had been through the same school of disappointments that had so annoyed me it is probable that he, instead of me, would now

be telling his friends back home about his series of victories over the enemy.

April in France is much like April anywhere else. Rains and cloudy weather appear suddenly out of a clear sky and flying becomes out of the question or very precarious at best. On the 29th of April, 1918, we rose at six o'clock and stuck our heads out of doors as usual for a hasty survey of a dismal sky. For the past three or four days it had rained steadily. No patrols had gone out from our aerodrome. If they had gone they would not have found any enemy aircraft about, for none had been sighted from the lines along our sector.

About noon the sun suddenly broke through and our hopes began to rise. I was slated for a patrol that afternoon and from three o'clock on I waited about the hangars watching the steadily clearing sky. Captain Hall and I were to stand on alert until six o'clock that night at the aerodrome. Precisely at five o'clock Captain Hall received a telephone call from the French headquarters at Beaumont stating that an enemy two-seater machine had just crossed our lines and was flying south over their heads.

Captain Hall and I had been walking about the field with our flying clothes on and our machines were standing side by side with their noses pointing into the wind. Within the minute we had jumped into our seats and our mechanics were twirling the propellers. Just then the telephone sergeant came running out to us and told Captain Hall to hold his flight until the Major was ready. He was to accompany us and would be on the field in two minutes.

While the sergeant was delivering the message I was scanning the northern heavens and there I suddenly picked up a tiny speck against the clouds above the Forêt de la Reine, which I was convinced must be the enemy plane we were after. The Major was not yet in sight. Our motors were smoothly turning over and everything was ready.

Pointing out the distant speck to Jimmy Hall, I begged him to give the word to go before we lost sight of our easy victim. If we waited for the Major we might be too late.

To my great joy Captain Hall acquiesced and immediately ordered the boys to pull away the blocks from our wheels. His motor roared as he opened up his throttle and in a twinkling both our machines were running rapidly over the surface of the field. Almost side by side we arose and climbing swiftly, soared away in a straight line after our distant Boche.

In five minutes we were above our observation balloon line which stretches along some two miles or so behind the front. I was on Jimmy's right wing and off to my right in the direction of Pont-a-Mousson I could still distinguish our unsuspecting quarry. Try as I might I could not induce the Captain to turn in that direction, though I dipped my wings, darted away from him and tried in every way to attract his attention to the target which was so conspicuous to me. He stupidly continued on straight north.

I determined to sever relations with him and take on the Boche alone, since he evidently was generous enough to give me a clear field. Accordingly I swerved swiftly away from Captain Hall and within five minutes overhauled the enemy

and adroitly maneuvered myself into an ideal position just under his sheltering tail. It was a large three-seater machine and a brace of guns poked their noses out to the rear over my head. With fingers closing on my triggers I prepared for a dash upwards and quickly pulled back my stick. Up I zoomed until my sights began to travel along the length of the fusilage overhead. Suddenly they rested on a curiously familiar looking device. It was the French circular cocard painted brightly under each wing! Up to this time I had not even thought of looking for its nationality, so certain had I been that this must be the Boche machine that had been sighted by the French headquarters.

Completely disgusted with myself, I viraged abruptly away from my latest blunder, finding some little satisfaction in witnessing the startled surprise of the three Frenchmen aboard the craft, who had not become aware of my proximity until they saw me flash past them. At any rate I had stalked them successfully and might have easily downed them if they had been Boches. But as it was, it would be a trifle difficult to face Jimmy Hall again and explain to him why I had left him alone to get myself five miles away under the tail of a perfectly harmless ally three-seater. I looked about to discover Jimmy's whereabouts.

There he was cavorting about amidst a thick barrage of black shell-bursts across the German lines. He was half-way to St. Mihiel and a mile or two inside Hun territory. Evidently he was waiting for me to discover my mistake and then overtake him, for he was having a delightful time with the Archy gun-

ners, doing loops, barrels, side-slips and spins immediately over their heads to show them his contempt for them, while he waited for his comrade. Finally he came out of the Archy area with a long graceful dive and swinging up alongside my machine he wiggled his wings as though he were laughing at me and then suddenly he set a course back towards Pont-a-Mousson.

Whether or not he knew all along that a German craft was in that region I could not tell. But when he began to change his direction and curve up into the sun I followed close behind him knowing that there was a good reason for this maneuver. I looked earnestly about me in every direction.

Yes! There was a scout coming towards us from north of Pont-a-Mousson. It was at about our altitude. I knew it was a Hun the moment I saw it, for it had the familiar lines of their new Pfalz. Moreover, my confidence in James Norman Hall was such that I knew he couldn't make a mistake. And he was still climbing into the sun, carefully keeping his position between its glare and the oncoming fighting plane. I clung as closely to Hall as I could. The Hun was steadily approaching us, unconscious of his danger, for we were full in the sun.

With the first downward dive of Jimmy's machine I was by his side. We had at least a thousand feet advantage over the enemy and we were two to one numerically. He might outdive our machines, for the Pfalz is a famous diver, while our faster climbing Nieuports had a droll little habit of shedding their fabric when plunged too furiously through the air. The Boche hadn't a chance to outfly us. His only salvation would be in a dive towards his own lines.

These thoughts passed through my mind in a flash and I instantly determined upon my tactics. While Hall went in for his attack I would keep my altitude and get a position the other side of the Pfalz, to cut off his retreat.

No sooner had I altered my line of flight than the German pilot saw me leave the sun's rays. Hall was already half-way to him when he stuck up his nose and began furiously climbing to the upper ceiling. I let him pass me and found myself on the other side just as Hall began firing. I doubt if the Boche had seen Hall's Nieuport at all.

Surprised by discovering this new antagonist, Hall, ahead of him, the Pfalz immediately abandoned all idea of a battle and banking around to the right started for home, just as I had expected him to do. In a trice I was on his tail. Down, down we sped with throttles both full open. Hall was coming on somewhere in my rear. The Boche had no heart for evolutions or maneuvers. He was running like a scared rabbit, as I had run from Campbell. I was gaining upon him every instant and had my sights trained dead upon his seat before I fired my first shot.

At 150 yards I pressed my triggers. The tracer bullets cut a streak of living fire into the rear of the Pfalz tail. Raising the nose of my aeroplane slightly the fiery streak lifted itself like the stream of water pouring from a garden hose. Gradually it settled into the pilot's seat. The swerving of the Pfalz course indicated that its rudder no longer was held by a directing hand. At 2000 feet above the enemy's lines I pulled up my headlong dive and watched the enemy machine

continuing on its course. Curving slightly to the left the Pfalz circled a little to the south and the next minute crashed onto the ground just at the edge of the woods a mile inside their own lines. I had brought down my first enemy aeroplane and had not been subjected to a single shot!

Hall was immediately beside me. He was evidently as pleased as I was over our success, for he danced his machine about in incredible maneuvers. And then I realized that old friend Archy was back on the job. We were not two miles away from the German anti-aircraft batteries and they put a furious bombardment of shrapnel all about us. I was quite ready to call it a day and go home, but Captain Hall deliberately returned to the barrage and entered it with me at his heels. Machine-guns and rifle fire from the trenches greeted us and I do not mind admitting that I got out quickly the way I came in without any unnecessary delay, but Hall continued to do stunts over their heads for ten minutes, surpassing all the acrobatics that the enraged Boches had ever seen even over their own peaceful aerodromes.

Jimmy exhausted his spirits at about the time the Huns had exhausted all their available ammunition and we started blithely for home. Swooping down to our field side by side, we made a quick landing and taxied our victorious machines up to the hangars. Then jumping out we ran to each other, extending glad hands for our first exchange of congratulations. And then we noticed that the squadron pilots and mechanics were streaming across the aerodrome towards us from all directions. They had heard the news while we were still dodging shrapnel

and were hastening out to welcome our return. The French had telephoned in a confirmation of my first victory, before I had had time to reach home. Not a single bullet hole had punctured any part of my machine.

There is a peculiar gratification in receiving congratulations from one's squadron for a victory in the air. It is worth more to a pilot than the applause of the whole outside world. It means that one has won the confidence of men who share the misgivings, the aspirations, the trials and dangers of aeroplane fighting. And with each victory comes a renewal and re-cementing of ties that bind together these brothers-in-arms. No closer fraternity exists in the world than that of the air-fighters in this great war. And I have yet to find one single individual who has attained conspicuous success in bringing down enemy aeroplanes who can be said to be spoiled either by his successes or by the generous congratulations of his comrades. If he were capable of being spoiled he would not have had the character to have won continuous victories, for the smallest amount of vanity is fatal in aeroplane fighting. Self-distrust rather is the quality to which many a pilot owes his protracted existence.

It was with a very humble gratitude then that I received the warm congratulations of Lufbery, whom I had always revered for his seventeen victories—of Doug Campbell and Alan Winslow who had brought down the first machines that were credited to the American Squadrons, and of many others of 94 Squadron who had seen far more service in the battle areas than had I. I was glad to be at last included in the

proud roll of victors of this squadron. These pals of mine were to see old 94 lead all American Squadrons in the number of successes over the Huns.

The following day I was notified that General Gerard, the Commanding Officer of the Sixth French Army, had offered to decorate Captain Hall and myself in the name of the French Government for our victory of the day before. We were then operating in conjunction with this branch of the French Army. The Croix de Guerre with palm was to be accorded each of us, provided such an order met the approval of our own government. But at that time officers in the American Army could not accept decorations from a foreign Government, so the ceremony of presentation was denied us. Both Captain Hall and myself had been included, as such was the French rule where two pilots participated in a victory.

The truth was that in the tense excitement of this first victory, I was quite blind to the fact that I was shooting deadly bullets at another aviator; and if I had been by myself, there is no doubt in my own mind but that I should have made a blunder again in some particular which would have reversed the situation. Captain Hall's presence, if not his actual bullets, had won the victory and had given me that wonderful feeling of self-confidence which made it possible for me subsequently to return to battle without him and handle similar situations successfully.

III

AMERICAN ACE OF ACES

On September 15th the weather was ideal for flying. I left

the aerodrome at 8:30 in the morning on a voluntary patrol, taking the nearest air route to the lines.

I had reached an altitude of 16,000 feet by the time I had reached the trenches. The visibility was unusually good. I could see for miles and miles in every direction. I was flying alone, with no idea as to whether other planes of our own were cruising about this sector or not. But barely had I reached a position over No Man's Land when I noticed a formation of six enemy Fokkers at about my altitude coming towards me from the direction of Conflans.

I turned and began the usual tactics of climbing into the sun. I noticed the Fokkers alter their direction and still climbing move eastward towards the Moselle. I did not see how they could help seeing me, as scarcely half a mile separated us. However, they did not attack nor did they indicate that they suspected my presence beyond continuing steadily their climb for elevation. Three complete circles they made on their side of the lines. I did the same on my side.

Just at this moment I discovered four Spad machines far below the enemy planes and some three miles inside the German lines. I decided at once they must belong to the American Second Fighting Group, at that time occupying the aerodrome at Souilly. They appeared to be engaged in bombing the roads and strafing enemy infantry from a low altitude. The Spads of the Second Pursuit Group had but recently been equipped with bomb racks for carrying small bombs.

The leader of the Fokker Formation saw the Spads at about the same moment I did. I saw him dip his wings and stick

down his nose. Immediately the six Fokkers began a head-long pique directly down at the Spads. Almost like one of the formation I followed suit.

Inside the first thousand feet I found I was rapidly overtaking the enemy machines. By the time we had reached 5,000 feet I was in a position to open fire upon the rear man. Not once had any of them looked around. Either they had forgotten me in their anxiety to get at their prey or else had considered I would not attempt to take them all on single-handed. At all events I was given ample time to get my man dead into my sights before firing.

I fired one long burst. I saw my tracer bullets go straight home into the pilot's seat. There came a sudden burst of fire from his fuel tank and the Fokker continued onwards in its mad flight—now a fiery furnace. He crashed a mile inside his own lines. His five companions did not stay to offer battle. I still held the upper hand and even got in a few bursts at the next nearest machine before he threw himself into a vrille and escaped me. The sight of one of their members falling in flames evidently quite discouraged them. Abandoning all their designs on the unsuspecting Spads below they dived away for Germany and left me the field.

I returned to my field, secured a car and drove immediately up to the lines to our Balloon Section. I wanted to get my victories confirmed—both this one of today and the Fokker that I had brought down yesterday in the same sector. For no matter how many pilots may have witnessed the bringing down of an enemy plane, official confirmation of their testi-

mony must be obtained from outside witnesses on the ground. Often these are quite impossible to get. In such a case the victory is not credited to the pilot.

Upon the tragic death of Major Lufbery, who at that time was the leading American Ace, with 18 victories, the title of American Ace of Aces fell to Lieutenant Paul Frank Baer of Fort Wayne, Ind., a member of the Lafayette Escadrille 103. Baer then had 9 victories and had never been wounded.

Baer is a particularly modest and lovable boy, and curiously enough he is one of the few fighting pilots I have met who felt a real repugnance in his task of shooting down enemy aviators.

When Lufbery fell, Baer's Commanding Officer, Major William Thaw, called him into the office and talked seriously with him regarding the opportunity before him as America's leading Ace. He advised Baer to be cautious and he would go far. Two days later Baer was shot down and slightly wounded behind the German lines!

Thereafter, Lieutenant Frank Bayliss of New Bedford, Mass., a member of the crack French Escadrille of the Cigognes, Spad 3, held the American title until he was killed in action on June 12, 1918. Bayliss had 13 victories to his credit.

Then David Putnam, another Massachusetts boy, took the lead with 12 victories over enemy aeroplanes. Putnam, as I have said, was, like Lufbery, shot down in flames but a day or two before my last victory.

Lieutenant Tobin of San Antonio, Texas, and a member of the Third Pursuit Group (of which Major William Thaw was the Commanding Officer), now had six official victories. He led

the list. I for my part had five victories confirmed. But upon receiving confirmation for the two Fokkers I had vanquished yesterday and to-day, I would have my seven and would lead Tobin by one. So it was with some little interest and impatience that I set off to try to find ground witnesses of my last two battles above St. Mihiel.

Mingled with this natural desire to become the leading fighting Ace of America was a haunting superstition that did not leave my mind until the very end of the war. It was that the very possession of this title—Ace of Aces—brought with it the unavoidable doom that had overtaken all its previous holders. I wanted it and yet I feared to learn that it was mine! In later days I began to feel that this superstition was almost the heaviest burden that I carried with me into the air. Perhaps it served to redouble my caution and sharpened my fighting senses. But never was I able to forget that the life of a title-holder is short.

Eating my sandwiches in the car that day I soon ran through St. Mihiel and made my way on the main road east to Apremont and then north to Thiaucourt. I knew that there had been a balloon up near there both days and felt certain that their observers must have seen my two combats overhead.

Unfortunately the road from Apremont to Thiaucourt was closed, owing to the great number of shellholes and trenches which criss-crossed it. After being lost for two hours in the forest which lies between St. Mihiel and Vigneulles, I was finally able to extricate myself and found I had emerged just south of Vigneulles. I was about one mile south of our

trenches. And standing there with map in hand wondering where to go next to find our balloons, I got an unexpected clue.

A sudden flare of flames struck my sight off to the right. Running around the trees I caught a view of one of our balloons between me and Thiaucourt completely immersed in flames! Half-way down was a graceful little parachute, beneath which swung the observer as he settled slowly to Mother Earth!

And as I gazed I saw a second balloon two or three miles further east towards Pont-a-Mousson perform the same maneuver. Another of our observers was making the same perilous jump! A sly Heinie had slipped across our lines and had made a successful attack upon the two balloons and had made a clean getaway. I saw him climbing up away from the furious gale of anti-aircraft fire which our gunners were speeding after him. I am afraid my sympathies were almost entirely with the airman as I watched the murderous bursting of Archy all around his machine. At any rate I realized exactly how he was feeling, with his mixture of satisfaction over the success of his undertaking and of panic over the deadly mess of shrapnel about him.

In half an hour I arrived at the balloon site and found them already preparing to go aloft with a second balloon. And at my first question they smiled and told me they had seen my Fokker of this morning's combat crash in flames. They readily signed the necessary papers to this effect, thus constituting the required confirmation for my last victory. But for the

victory of yesterday that I claimed they told me none of the officers were present who had been there on duty at that time. I must go to the 3rd Balloon Company just north of Pont-a-Mousson and there I would find the men I wanted to see.

After watching the new balloon get safely launched with a fresh observer in the basket, a process which consumed some ten or fifteen minutes, I retraced my steps and made my way back to my motor. The observer whom I had seen descending under his parachute had in the meantime made his return to his company headquarters. He was unhurt and quite enthusiastic over the splendid landing he had made in the trees. Incidentally I learned that but two or three such forced descents by parachute from a flaming balloon are permitted any one observer. These jumps are not always so simple and frequently very serious if not fatal injuries are received in the parachute jump. Seldom does one officer care to risk himself in a balloon basket after his third jump. And this fear for his own safety limits very naturally his service and bravery in that trying business. The American record in this perilous profession is held, I believe, by Lieutenant Phelps of New York, who made five successive jumps from a flaming balloon.

On my way to the 3rd Balloon Company I stopped to enquire the road from a group of infantry officers whom I met just north of Pont-a-Mousson. As soon as I stated my business, they unanimously exclaimed that they had all seen my flight above them yesterday and had seen my victim crash near them. After getting them to describe the exact time and place and some of the incidents of the fight I found that it

was indeed my combat they had witnessed. This was a piece of real luck for me. It ended my researches on the spot. As they were kindly signing their confirmation I was thinking to myself, "Eddie! You are the American Ace of Aces!" And so I was for the minute.

Returning home, I lost no time in putting in my reports. Reed Chambers came up to me and hit me a thump on the back.

"Well, Rick!" he said, "how does it feel?"

"Very fine for the moment, Reed," I replied seriously, "but any other fellow can have the title any time he wants it, so far as I am concerned."

I really meant what I was saying. A fortnight later when Frank Luke began his marvelous balloon strafing he passed my score in a single jump. Luke, as I have said, was on the same aerodrome with me, being a member of 27 Squadron. His rapid success even brought 27 Squadron ahead of 95 Squadron for a few days.

The following day I witnessed a typical expedition of Luke's from our own aerodrome. Just about dusk on September 16th Luke left the Major's headquarters and walked over to his machine. As he came out of the door he pointed out the two German observation balloons to the east of our field, both of which could be plainly seen with the naked eye. They were suspended in the sky about two miles back of the Boche lines and were perhaps four miles apart.

"Keep your eyes on these two balloons," said Frank as he passed us. "You will see that first one there go up in flames exactly at 7:15 and the other will do likewise at 7:19."

We had little idea he would really get either of them, but we all gathered together out in the open as the time grew near and kept our eyes glued to the distant specks in the sky. Suddenly Major Hartney exclaimed, "There goes the first one!" It was true! A tremendous flare of flame lighted up the horizon. We all glanced at our watches. It was exactly on the dot!

The intensity of our gaze towards the location of the second Hun balloon may be imagined. It had grown too dusk to distinguish the balloon itself, but we well knew the exact point in the horizon where it hung. Not a word was spoken as we alternately glanced at the second-hands of our watches and then at the eastern skyline. Almost upon the second our watching group yelled simultaneously. A small blaze first lit up the point at which we were gazing. Almost instantaneously another gigantic burst of flames announced to us that the second balloon had been destroyed! It was a most spectacular exhibition.

We all stood by on the aerodrome in front of Luke's hangar until fifteen minutes later we heard through the darkness the hum of his returning motor. His mechanics were shooting up red Very lights with their pistols to indicate to him the location of our field. With one short circle above the aerodrome he shut off his motor and made a perfect landing just in front of our group. Laughing and hugely pleased with his success, Luke jumped out and came running over to us to receive our heartiest congratulations. Within a half hour's absence from the field Frank Luke had destroyed a hundred thousand dollars'

worth of enemy property! He had returned absolutely unscratched.

A most extraordinary incident had happened just before Luke had left the ground. Lieutenant Jeffers of my Squadron had been out on patrol with the others during the afternoon and did not return with them. I was becoming somewhat anxious about him when I saw a homing aeroplane coming from the lines towards our field. It was soon revealed as a Spad and was evidently intending to land at our field, but its course appeared to be very peculiar. I watched it gliding steeply down with engine cut off. Instead of making for the field, the pilot, whoever he was, seemed bent upon investigating the valley to the north of us before coming in. If this was Jeff he was taking a foolish chance, since he had already been out longer than the usual fuel supply could last him.

Straight down at the north hillside the Spad continued its way. I ran out to see what Jeff was trying to do. I had a premonition that everything was not right with him.

Just as his machine reached the skyline I saw him make a sudden effort to redress the plane. It was too late. He slid off a little on his right wing, causing his nose to turn back towards the field—and then he crashed in the fringe of bushes below the edge of the hill. I hurried over to him.

Imagine my surprise when I met him walking towards me, no bones broken, but wearing a most sheepish expression on his face. I asked him what in the world was the matter.

"Well," he replied, "I might as well admit the truth! I went to sleep coming home, and didn't wake up until I was

about ten feet above the ground. I didn't have time to switch on my engine or even flatten out! I'm afraid I finished the little 'bus!"

Extraordinary as this tale seemed, it was nevertheless true. Jeffers had set his course for home at a high elevation over the lines and cutting off his engine had drifted smoothly along. The soft air and monotonous luxury of motion had lulled him to sleep. Subconsciously his hand controlled the joystick or else the splendid equilibrium of the Spad had kept it upon an even keel without control. Like the true old coach-horse it was, it kept the stable door in sight and made directly for it. Jeff's awakening might have been in another world, however, if he had not miraculously opened his eyes in the very nick of time!

The next day, September 18th, our group suffered a loss that made us feel much vindictiveness as well as sorrow. Lieutenant Heinrichs and Lieutenant John Mitchell, both of 95 Squadron, were out together on patrol when they encountered six Fokker machines. They immediately began an attack.

Mitchell fired one burst from each gun and then found them both hopelessly jammed. He signaled to Heinrichs that he was out of the battle and started for home. But at the same moment Heinrichs received a bullet through his engine which suddenly put it out of action. He was surrounded by enemy planes and some miles back of the German lines. He broke through the enemy line and began his slow descent. Although it was evident he could not possibly reach our lines, the furious Huns continued swooping upon him, firing again and again as he coasted down.

Ten different bullets struck his body in five different attacks. He was perfectly defenseless against any of them. He did not lose consciousness, although one bullet shattered his jaw-bone and bespattered his goggles so that he could not see through the blood. Just before he reached the ground he managed to push up his goggles with his unwounded arm. The other was hanging limp and worthless by his side.

He saw he was fairly into a piece of woodland and some distance within the German lines. He swung away and landed between the trees, turning his machine over as he crashed, but escaping further injury himself. Within an hour or two he was picked up and taken to a hospital in Metz.

After the signing of the Armistice we saw Heinrichs again at the Toul Hospital. He was a mere shell of himself. Scarcely recognizable even by his old comrades, a first glance at his shrunken form indicated that he had been horribly neglected by his captors. His story quickly confirmed this suspicion.

For the several weeks that he had lain in the Metz hospital he told us that the Germans had not reset either his jaw or his broken arm. In fact he had received no medical attention whatsoever. The food given him was bad and infrequent. It was a marvel that he had survived this frightful suffering!

In all fairness to the Hun I think it is his due to say that such an experience as Heinrichs suffered rarely came to my attention. In the large hospital in which he was confined there were but six nurses and two doctors. They had to care for several scores of wounded. Their natural inclination was to care for their own people. But how any people calling them-

selves human could have permitted Heinrichs' suffering to go uncared for during all those weeks passes all understanding. Stories of this kind which occasionally came to our ears served to steel our hearts against any mercy towards the enemy pilots in our vicinity.

And thus does chivalry give way before the horrors of war—even in aviation!

IV

LAST VICTORY OF THE GREAT WAR

Returning from Paris on November 5th I found it still raining. Almost no flying had been possible along this sector since my departure. In fact no patrol left our field until November 8th, the same day on which we caught by wireless the information that the Boche delegates had crossed the lines between Haudry and Cheme on the La Chapelle road to sign the armistice. Peace then was actually in sight.

For weeks there had been a feeling in the air that the end of the war was near. To the aviators who had been flying over the lines and who had with their own eyes seen the continuous withdrawals of the Germans to the rear there was no doubt but that the Huns had lost their immoderate love for fighting and were sneaking homewards as fast as their legs would carry them. Such a certainty of victory should have operated to produce a desire to live and let live among men who were desirous of "seeing the end of the war," that is, men who preferred to survive rather than run the risks of combat fighting now that the war was fairly over.

But it was at this very period of my leadership of the 94th Squadron that I found my pilots most infatuated with fighting. They importuned me for permission to go out at times when a single glance at the fog and rain showed the foolishness of such a request. Not content with the collapse of the enemy forces the pilots wanted to humiliate them further with flights deep within their country where they might strafe aeroplane hangars and retreating troops for the last time. It must be done at once, they feared, or it would be too late.

On the 9th day of November Lieutenant Dewitt and Captain Fauntleroy came to me after lunch and begged me to go to the door of my hut and look at the weather with them. I laughed at them but did as they requested. It was dark and windy outside, heavy low clouds driving across the sky, though for the moment no rain was falling. I took a good look around the heavens and came back to my room, the two officers following me. Here they cornered me and talked volubly for ten minutes, urging my permission to let them go over the lines and attack one last balloon which they had heard was still swinging back of the Meuse. They overcame every objection of mine with such earnestness that finally against my best judgment I acquiesced and permitted them to go. At this moment Major Kirby who had just joined 94 Squadron for a little experience in air fighting before taking command of a new group of Squadrons that was being formed, and who as yet had never flown over the lines stepped into the room and requested permission to join Dewitt and Fauntleroy in their expedition. Lieutenant Cook would go along with him, he said,

and they would hunt in pairs. If they didn't take this opportunity the war might end overnight and he would never have had a whack at an enemy plane.

Full of misgivings at my own weakness I walked out to the field and watched the four pilots get away. I noted the time on my watch, noted that a heavy wind was blowing them away and would increase their difficulties in returning, blamed myself exceedingly that I had permitted them to influence me against my judgment. The next two hours were miserable ones for me.

The weather grew steadily worse, rain fell and the wind grew stronger. When darkness fell, shortly after four o'clock, I ordered all the lights turned on the field and taking my seat at the mouth of our hangar I anxiously waited for a glimpse of the homecoming Spads. It was nearing the limit of their fuel supply and another ten minutes must either bring some word from them or I should know that by my orders four pilots had sacrificed themselves needlessly after hostilities had practically ceased. I believe that hour was the worst one I have ever endured.

Night fell and no aeroplanes appeared. The searchlights continued to throw their long fingers into the clouds, pointing the way home to any wandering scouts who might be lost in the storm. Foolish as it was to longer expect them I could not order the lights extinguished and they shone on all through the night. The next day was Sunday and another Decorations Ceremony was scheduled to take place at our field at eleven o'clock. A number of pilots from other aerodromes were com-

ing over to receive the Distinguished Service Cross from the hands of General Liggett for bravery and heroic exploits over enemy's lines. Several of our own Group, including myself were to be among the recipients.

The band played, generals addressed us and all the men stood at attention in front of our line of fighting planes while the dignified ceremony was performed. Two more palms were presented to me to be attached to my decoration. The Army Orders were read aloud praising me for shooting down enemy aeroplanes. How bitter such compliments were to me that morning nobody ever suspected. Not a word had come from any one of my four pilots that I had sent over the lines the day before. No explanation but one was possible. All four had been forced to descend in enemy territory—crashed, killed or captured—it little mattered so far as my culpability was concerned.

In fact a message had come in the night before that a Spad had collided in air with a French two-seater near Beaumont late that afternoon. A hurried investigation by telephone disclosed the fact that no other Spads were missing but our own—thus filling me with woeful conjectures as to which one of my four pilots had thus been killed in our own lines.

At the conclusion of the presentation of decorations I walked back to the hangar and put on my coat, for it was a freezing day and we had been forced to stand for half an hour without movement in dress tunic and breeches. The field was so thick with fog that the photographers present could scarcely get light enough to snap the group of officers standing in line.

No aeroplanes could possibly be out to-day or I should have flown over to Beaumont at daybreak to ascertain which of my pilots had been killed there.

I was invited to mess with 95 Squadron that noon and I fear I did not make a merry guest. The compliments I received for my newly received decorations fell on deaf ears. As soon as I decently could get away I made my adieus and walked back across the aerodrome. And about half-way across I saw an aeroplane standing in the center of the field. I looked at it idly, wondering what idiot had tried to get away in such a fog. Suddenly I stopped dead in my tracks. The Spad had a Hat-in-the-Ring painted on its fusilage--and a large number "3" was painted just beyond it. Number "3" was Fauntleroy's machine!

I fairly ran the rest of the way to my hangar where I demanded of the mechanics what news they had heard about Captain Fauntleroy. I was informed that he had just landed and had reported that Lieutenant Dewitt had crashed last night inside our lines but would be back during the course of the day. And to cap this joyful climax to a day's misery I was told five minutes later at Group Headquarters that Major Kirby had just telephoned in that he had shot down an enemy aeroplane across the Meuse this morning at ten o'clock, after which he had landed at an aerodrome near the front and would return to us when the fog lifted!

It was a wild afternoon we had at 94 mess upon receipt of this wonderful news. Cookie too was later heard from, he having experienced a more serious catastrophe the previous

afternoon. He had attacked an observation balloon near Beaumont. The Hun defenses shot off one blade of his propeller and he had barely made his way back across the lines when he was compelled to land in the shell-holes which covered this area. He escaped on foot to the nearest American trench and late Sunday afternoon reached our mess.

Major Kirby's victory was quickly confirmed, later inquiries disclosing the wonderful fact that this first remarkable victory of his was in truth the last aeroplane shot down in the Great War! Our old 94 Squadron had won the first American victory over enemy aeroplanes when Alan Winslow and Douglas Campbell had dropped two biplane machines on the Toul aerodrome. 94 Squadron had been first to fly over the lines and had completed more hours flying at the front than any other American organization. It had won more victories than any other—and now, for the last word, it had the credit of bringing down the last enemy aeroplane of the war! One can imagine the celebration with which 94 Squadron would signalize the end of the war! What could Paris or any other community in the whole world offer in comparison?

And the celebration came even before we had lost the zest of our present gratitude and emotion.

The story of Major Kirby's sensational victory can be told in a paragraph. He had become lost the night before and had landed on the first field he saw. Not realizing the importance of telephoning us of his safety, he took off early next morning to come home. This time he got lost in the fog which surrounded our district. When he again emerged into clear

air he found he was over Etain, a small town just north of Verdun. And there flying almost alongside of his Spad was another aeroplane which a second glance informed him was an enemy Fokker! Both pilots were so surprised for a moment that they simply gazed at each other. The Fokker pilot recovered his senses first and began a dive towards earth. Major Kirby immediately piqued on his tail, followed him down to within fifty feet of the ground firing all the way. The Fokker crashed head on, and Kirby zoomed up just in time to avoid the same fate. With his usual modesty Major Kirby insisted he had scared the pilot to his death. Thus ended the War in the Air on the American front.

While listening to these details that evening after mess, our spirits bubbling over with excitement and happiness, the telephone sounded and I stepped over and took it up, waving the room to silence. It was a message to bring my husky braves over across to the 95 Mess to celebrate the beginning of a new era. I demanded of the speaker, (it was Jack Mitchell, Captain of the 95th) what he was talking about.

"Peace has been declared! No more fighting!" he shouted. "*C'est le finis de la Guerre.*"

Without reply I dropped the phone and turned around and faced the pilots of 94 Squadron. Not a sound was heard, every eye was upon me but no one made a movement or drew a breath. It was one of those peculiar psychological moments when instinct tells every one that something big is impending.

In the midst of this uncanny silence a sudden BOOM-BOOM of our Archy battery outside was heard. And then pandemo-

nium broke loose. Shouting like mad, tumbling over one another in their excitement the daring pilots of the Hat-in-the-Ring Squadron sensing the truth darted into trunks and kitbags, drew out revolvers, German Lugers, that some of them had found or bought as souvenirs from French poilus, Very pistols and shooting tools of all descriptions and burst out of doors. There the sky over our old aerodrome and indeed in every direction of the compass was aglow and shivering with bursts of fire. Searchlights were madly cavorting across the heavens, paling to dimness the thousands of colored lights that shot up from every conceivable direction. Shrill yells pierced the darkness around us, punctuated with the fierce rat-tat-tat-tat of a score of machine-guns which now added their noise to the clamor. Roars of laughter and hysterical whoopings came to us from the men's quarters beside the hangars. Pistol shots were fired in salvos, filled and emptied again and again until the weapon became too hot to hold.

At the corner of our hangar I encountered a group of my pilots rolling out tanks of gasoline. Instead of attempting the impossible task of trying to stop them I helped them get it through the mud and struck the match myself and lighted it. A dancing ring of crazy lunatics joined hands and circled around the blazing pyre, similar howling and revolving circuses surrounding several other burning tanks of good United States gasoline that would never more carry fighting aeroplanes over enemy's lines. The stars were shining brightly overhead and the day's mist was gone. But at times even the stars were hidden by the thousands of rockets that darted up over our

heads and exploded with their soft 'plonks, releasing varicolored lights which floated softly through this epochal night until they withered away and died. Star shells, parachute flares, and streams of Very lights continued to light our way through an aerodrome seemingly thronged with madmen. Everybody was laughing—drunk with the outgushing of their long pent-up emotions. "*I've lived through the war!*" I heard one whirling Dervish of a pilot shouting to himself as he pirouetted alone in the center of a mud hole. Regardless of who heard the inmost secret of his soul, now that the war was over, he had retired off to one side to repeat this fact over and over to himself until he might make himself sure of its truth.

Another pilot, this one an Ace of 27 Squadron, grasped me securely by the arm and shouted almost incredulously, "*We won't be shot at any more!*" Without waiting for a reply he hastened on to another friend and repeated this important bit of information as though he were doubtful of a complete understanding on this trivial point. What sort of a new world will this be without the excitement of danger in it? How queer it will be in future to fly over the dead line of the silent Meuse—that significant boundary line that was marked by Arch shells to warn the pilot of his entrance into danger.

How can one enjoy life without this highly spiced sauce of danger? What else is there left to living now that the zest and excitement of fighting aeroplanes is gone? Thoughts such as these held me entranced for the moment and were afterwards recalled to illustrate how tightly strung were the nerves of these boys of twenty who had for continuous months been living on the very peaks of mental excitement.

In the mess hall of Mitchell's Squadron we found gathered the entire officer personnel of the Group. Orderlies were running back and forth with cups brimming with a hastily concocted punch, with which to drink to the success and personal appearance of every pilot in aviation. Songs were bellowed forth accompanied by crashing sounds from the Boche piano—the proudest of 95's souvenirs, selected from an officer's mess of an abandoned German camp. Chairs and benches were pushed back to the walls and soon the whole roomful was dancing, struggling and whooping for joy, to the imminent peril of the rather temporary walls and floor. Some unfortunate pilot fell and in a trice everybody in the room was forming a pyramid on top of him. The appearance of the C. O. of the Group brought the living mass to its feet in a score of rousing cheers to the best C. O. in France. Major Hartney was hoisted upon the piano, while a hundred voices shouted, "SPEECH—SPEECH!" No sooner did he open his lips than a whirlwind of sound from outside made him pause and reduced the room to quiet. But only for an instant.

"It's the Jazz Band from old 147!" yelled the pilots and like a tumultuous waterfall they poured *en masse* through a doorway that was only wide enough for one at a time.

Whooping, shrieking and singing, the victors of some 400-odd combats with enemy airmen encircled the musicians from the enlisted men of 147 Squadron. The clinging clay mud of France lay ankle deep around them. Within a minute the dancing throng had with their hopping and skipping plowed it into an almost bottomless bog. Some one went down, drag-

ging down with him the portly bass drummer. Upon his foundation human forms in the spotless uniforms of the American Air Service piled themselves until the entire Group lay prostrate in one huge pyramid of joyous aviators. It was later bitterly disputed as to who was and who was not at the very bottom of this historic monument erected that night under the starry skies of France to celebrate the extraordinary fact that we had lived through the war and were not to be shot at to-morrow.

It was the "*finis de la Guerre!*" It was the *finis d'aviation*. It was to us, perhaps unconsciously, the end of that intimate relationship that since the beginning of the war had cemented together brothers-in-arms into a closer fraternity than is known to any other friendship in the whole world. When again will that pyramid of entwined comrades—interlacing together in one mass boys from every State in our Union—when again will it be formed and bound together in mutual devotion?

THE GAUNTLET OF FIRE

I

IF an airman in war could fly always under favourable conditions, and was not obliged often to descend quite near the earth, he would have little to fear from the anti-aircraft guns. But when he ascends on active service he has a definite mission to fulfil. He must survey some position, whether the air is clear or misty; or he must carry his bombs above a certain point and then descend low enough, before he drops them, to give them the best possible chance of hitting their target. Thus in one flight, if the weather is favourable, and the observation he has to make proves simple, he may run very little risk from hostile gunfire; while on another occasion, taking bombs with him to drop, say, on a railway station that is well defended, he may have to dive deliberately into a zone of heavy fire, and trust to luck and his own skill to save him from annihilation.

The danger that threatens a pilot when he is compelled to descend near the earth, and pass within close range of a position where there are anti-aircraft guns, has been demonstrated many times during the war; and, of unofficial stories available, that which follows is one of the most striking.

From Heroes of the Flying Corps

During March 1915, with the idea of harassing the Germans as much as possible in their submarine warfare, our Naval Air Service organised attacks by air, on the extensive scale, against the bases the Germans had established along the Belgian coast. In one of these raids a British naval pilot, flying a seaplane and armed with bombs, was instructed to fly above a certain position and release his missiles to the best advantage. He started accordingly and arrived above his objective, being at an altitude of about 8,000 feet. This height was too great for anything like effective bomb-dropping; so he marked the point he wished to attack, and brought his machine down in a swift, steep dive. The enemy had seen him and guessed his intention, and were ready to give him a hot reception. Several thousand feet he descended, shells bursting all round him; then one of them, exploding quite near his machine, jerked its bow downward, owing to the air disturbance of the explosion, until he was diving almost vertically towards the ground; while some of the shrapnel bullets, besides puncturing his wings, struck and damaged his engine, putting two of its cylinders out of action.

But the aviator was undeterred; he had no intention of abandoning his task. Regaining control of his machine, and with shells still bursting near him, he continued his descent and began to drop his bombs. Again a well-placed shell came perilously near him. This time one of the bullets scratched his cheek; while others, passing between his sustaining planes, cut several wires and weakened dangerously one of the wings. Still he remained within fire until he had dropped the last of

his bombs; then, turning his crippled machine, he steered seaward in an endeavour to return to his starting-point. But his motor, damaged as it had been, failed to give him enough power to maintain his craft in flight; while one of his planes threatened at any moment to collapse. The only thing for him to do was to plane down towards the sea and alight on it, his craft resting on its floats. This he did; and immediately the machine was floating on the water he moved back from his driving-seat to the engine, endeavouring to repair it sufficiently to enable him to resume his flight. But in this he failed; and the end of his adventure was that his craft drifted down the sea-coast until it arrived in neutral waters, where the pilot was rescued only to be interned.

II

During the worst of the winter weather, when our air scouts were obliged—if they wanted to see the movements of the enemy—to fly low through zones of gunfire, there were some extraordinary escapes from death.

One British military pilot, accompanied by an observer, setting out on a special reconnaissance on a misty day, had to risk passing low near some of the enemy's batteries. A deadly fire was—according to the unofficial story told concerning this incident—concentrated upon his machine. One shot hit an interplane strut and smashed it; many more tore holes through the wings; and then, damaged by a shot, the motor ceased to revolve. The airman turned and began to plane towards his own lines. These he reached, though only

by prolonging his glide to its limit. And then, when he was only a hundred feet or so above the ground, his machine passed suddenly beyond his control and dived helplessly to earth.

The craft was badly smashed by the impact, and it seemed to those who saw the fall that both its occupants must have been killed; but the pilot escaped with a damaged leg—it had been caught and pinned down beneath the motor—while the observer was lucky enough to sustain only minor injuries.

III

A German aviator, piloting a Gotha type of Taube monoplane, has described a flight of 170 miles he made across the Meuse, examining a French line of defence on the western bank.

He started at dawn with a German officer as his observer, and they flew first towards a French fortification, which they had been ordered to inspect. Here, however, guns were fired at them, and they were chased by three hostile aeroplanes; but they managed to escape and continued on their way. Then they came in view of a large body of French troops, and saw a company of soldiers, halting in a road, raise their rifles to their shoulders and fire a volley at the aeroplane. The pilot, sitting anxiously in his driving-seat, waited for the effect of this fire. Suddenly the monoplane trembled; but the motor did not stop, and the machine continued its flight. Bullets had penetrated its wings, but had struck no vital part; and the airman was able to complete his observation, and return to his base.

IV

One of the most daring feats of the war, in its defiance by an airman of a concentration of gunfire, occurred during an attack that was planned, in April, against an airship shed the Germans had erected in the neighbourhood of Ghent. This shed, one of great strategic importance to the Germans, was guarded not only by anti-aircraft guns on the ground, but also by marksmen who were stationed at some altitude in the car of a captive balloon. Yet it was against this position, completely armed though it was and with its defenders on the alert, that one of our airmen, flying single-handed in a fast machine, delivered a successful attack; the details of which, as set forth below, are compiled from both official and unofficial sources.

With three powerful bombs in his machine, besides hand-grenades, he arrived above the airship shed in the calm of the evening, flying at a considerable altitude. For awhile he reconnoitred; then, from a height of 6000 feet, he dropped one of his bombs at the airship shed, which lay very clearly revealed below him. Immediately he had discharged this bomb, he found that those in the car of the captive balloon were firing at him; while a heavy fusillade was being directed also from the ground. He was still too high to make good practice with his bombs against the shed, and yet it seemed to be courting almost certain death to descend any lower, in view of the storm of shot that was being launched against him. He flew in a circle, considering the position; then he decided on a method of attack which could have been carried out only by a pilot who was exceptionally skilled. Flying until he was exactly above the

balloon in which the marksmen were stationed who were firing volleys at him, he began to descend very rapidly, steering his machine in a series of small, steeply-banked spirals, which kept him so directly above the balloon that the occupants of its car, with the gas-container between them and the descending aeroplane, were unable to see the machine or fire upon it.

Stealing down in this way, and shielding himself against the fire from the balloon—at which by the way he hurled a bomb that missed its mark—the airman came down until he was just over the balloon; then, with a rapid outward swerve, he passed it on his descent and came even nearer the ground—the car of the balloon being above him now, and his machine exposed to the fire of those who were stationed on the ground. But, owing to the pilot's clever flying, the Germans were still in a quandary. He kept his machine moving in the smallest of circles, immediately under the balloon. Thus the men in its car, when they aimed down on the aeroplane, were in danger with every shot of hitting their comrades, who were grouped around the airship shed; while the gunners on the ground, when they came to fire upward at the aeroplane, ran the risk of killing or wounding those who were in the balloon.

The airman, profiting by the confusion this shrewd manœuvre caused, came down within 200 feet of the ground. Then, and not till then, did he drop the last of his heavy bombs. This, released at such a point-blank range, struck the roof of the airship shed; and the impact was followed by a heavy explosion from within the shed. But the aviator did not, as may be imagined, wait to see exactly what damage his bomb had done.

In extreme peril, every moment he remained within such short range, he steered away rapidly from the scene of conflict, and returned to his base with no greater injuries to his machine than the perforation of its planes by a number of bullets; he himself being unhurt, despite the volume of fire that had been directed against him.

V

An exploit that needed exceptional courage, and unusual skill also, was that of Flight-Lieutenant Marix at Dusseldorf, in the early stages of the war. He, with two other naval aviators, had been detailed to make a raid by aeroplane on the important Zeppelin air station that has been established at Dusseldorf, and endeavour if possible to destroy one of these giant aircraft while it lay in its shed. A previous raid, in which bombs were dropped with effect by Flight-Lieutenant Collet, had been made against Dusseldorf; but in this case the weather had proved unfavourable, and sufficient damage had not been done. Therefore a second attack was planned, and carried out—as described below largely from official sources—under weather conditions which were more favourable.

Lieut. Marix was flying a very fast single-seated biplane; and on this machine, after invading Germany by air for more than 100 miles—starting his flight from a point near Antwerp—he arrived over Dusseldorf and came in sight of the Zeppelin sheds. These were very completely guarded, there being machine-guns fixed on their roofs, with larger anti-aircraft guns stationed on the ground near by, and picked riflemen ready to

fire volleys upward. But Lieut. Marix, despite this armament, flew straight towards his goal, descending as he approached the sheds until he was not more than 500 feet high. He relied on the speed of his flight, and his own dexterity in controlling his machine, to carry him through this area of fire. How violent the gunfire was, and what peril the aviator ran, may be guessed from the fact that, though he flew over the shed at a very high speed—seeming indeed to dash in and out of range almost in a moment—his craft was hit several times by shot before he could escape out of range. Most of these hits, however, were merely punctures of his wing fabric and had no significance; but one shot, by such a stroke of ill-luck as may cost an airman his life, severed a couple of his control wires. This was extremely serious of course, but not as it happened fatal. The biplane, though crippled, was just controllable—at any rate to so skilled a pilot as Lieut. Marix. He contrived to remain aloft and to steer his craft; in fact, though flying all the time under great difficulties, he succeeded in returning to a point within fifteen miles of Antwerp. Here his petrol failed him, and he had to land in dangerous proximity to the German lines. Fortunately for him, however, an armoured Belgian motor-car had been waiting about the roads so as to be ready, if necessary, to aid the British pilots on their return from their flight. Those in charge of this car saw Lieut. Marix descend, and came promptly to his assistance. But his machine had landed so near one of the advance posts of the enemy that it was considered too risky to attempt to dismantle it and transport it to the Belgian lines. At any moment the party might

have been surprised by German cavalymen. So the biplane, which had served its pilot so well, was destroyed where it had alighted so that it might not come into the hands of the enemy; and then Lieut. Marix, entering the armoured car, was driven swiftly into Antwerp.

His raid on the Zeppelin sheds had been well worth while. In passing above one of the sheds, in which a Zeppelin was lying berthed, he had managed to drop two of his bombs with accuracy. Both of them, striking the roof of the shed, had punctured it and burst inside; and, within thirty seconds of their explosion, a sheet of flame had shot out from within the shed, rising high into the air. This showed, without any doubt, that one or more of the gas-containers of a Zeppelin had been pierced, and the gas within them ignited. And this would mean that the airship would be destroyed. Such, in fact, seems clearly to have been the case. Reports reached our authorities subsequently, from various sources, which placed it beyond doubt that Lieut. Marix had, with these two bombs, brought about the destruction of the Zeppelin that lay in the shed.

VI

Mr. Robert Loraine, the actor who learned to pilot an aeroplane soon after Bleriot had flown the Channel in 1909, and who has made some remarkable flights—including an aerial crossing of the Irish Sea—went to France as a pilot in the Royal Flying Corps, and had an adventure in November, 1914, which nearly cost him his life. He had made several scouting flights, and had been fired at by a battery whose attentions

he had begun to notice particularly, but the shells from which he was for a time able to avoid. One day, however—according to details published unofficially—a shell burst quite close to his machine, and a shrapnel bullet, striking Mr. Loraine in the back, passed completely through his body and came out near his neck, perforating his right lung. His companion in the aeroplane, who was acting at the time as pilot, returned quickly to their headquarters, and Mr. Loraine was taken to hospital. His wound, though very serious, did not prove fatal.

VII

It is not always, indeed, skilled though he may be, that a pilot escapes without injury from a zone of heavy fire. Take the case of M. Verrier, a French aviator who, after flying for several seasons at the London Aerodrome, Hendon, and being an extremely popular figure at that flying ground, joined the French air service at the beginning of the war, and was soon doing valuable work as a scout.

One day, with an observation officer flying as passenger in his machine, he was passing above the enemy's lines. The weather, unfortunately for him, was not good for aerial scouting. There were low-lying clouds; and so he had to creep nearer and nearer the earth, until he was well within rifle range of any hostile bodies of troops which might lurk below him. And it was at this moment—according to M. Verrier's own statement—while the aeroplane was in a dangerous proximity to the earth, that it came under the fire of a body of German infantry. The first bullet that reached the machine passed

through a map the observation officer was holding in his hands. And then, before M. Verrier could ascend, or steer his craft out of this danger-zone, there came a second bullet into the hull of the machine which wounded the observer in the foot. The pilot, of course, was now climbing as rapidly as he could, hoping to escape out of range with no further damage than he had already sustained. But the rifle fire from the ground was exceptionally heavy; and in a moment or so, while the biplane was ascending steeply, a bullet tore its way through the floor-boards of the hull and struck M. Verrier just near the ankle, piercing his leg as far as the knee—where it emerged—leaving him with a painful wound.

The position of an airman who is wounded, while flying thus above the lines of the enemy, is serious in the extreme. If he stops his engine, and descends at once, he knows he will be made a prisoner, and that his headquarters will lose the value of any news he may have gleaned; while if he flies on, striving to regain his own lines before he descends, he may be so overcome by weakness, owing to shock and loss of blood, that he will collapse suddenly over his control levers. And this, in all probability, will mean death, seeing that the aeroplane, with the pilot ceasing to control it, will side-slip or dive towards the earth, and end its career in a helpless fall, perhaps on a roof of a building or in the tree-tops of a wood.

M. Verrier, wounded though he was, did not hesitate as to what he should do. He had, before being hit, gained information as to the enemy's dispositions that was of value; and this, come what may, he determined should be carried back to the

French headquarters. So he turned his biplane, operating the rudder-bar with difficulty owing to his injured leg, and made off towards the French lines, which were more than ten miles away. Each minute, as he flew, he felt weaker; but still he clung grimly to his levers, watched anxiously by the passenger—who knew that his life, as well as that of the airman, depended on the spirit and endurance the latter could display.

The flight was made. Almost exhausted, scarcely able at the last to control the movements of his machine, M. Verrier regained his starting-point and planed to earth; and the news he had to communicate was borne in safety to headquarters.

VIII

Less fortunate, though equally courageous, was M. Raymond, a French senator who had learned to fly before the war, and who joined the aviation service and did excellent work as a scout. One day—as the story is told unofficially in France—he was despatched on an urgent reconnaissance, and passed above the German battle-front, securing in the course of his flight some important news. Then, turning his craft, he steered towards the French lines. But suddenly, just as he was passing over the advanced trenches of the Germans, he came into a zone of rifle fire. Bullets hummed past his machine; and presently one, entering the hull, wounded him seriously.

He did not collapse, though he felt his strength was failing. The distance to be flown, before he could regain the French lines, was not great; in a few minutes, in fact, he knew he would be over his own troops. But he was unable to reach them. Overcome by exhaustion, he was compelled to plane to earth;

and the point at which he alighted was almost exactly midway between the German and French trenches.

Germans ran out to capture him, and at the same time a party of French soldiers, eager to rescue the fallen aviator, dashed also from their trenches. Whereupon there was a fierce encounter, in which the French were successful, and brought back the wounded pilot to their own lines.

Here, though sinking fast, he was able to furnish particulars to his superiors of the reconnaissance he had made; and then a few hours later he died—but not before the Cross of the Legion of Honour had been pinned on his breast.

IX

There are two points in regard to these stories that are interesting—apart from the courage the pilots displayed. One is the question of protecting the hull of an aeroplane from gunfire by means of armour-plating. If, for instance, the hull of his craft had been armoured, the bullet that struck M. Verrier would have been unable to penetrate the floor-boards. Why, therefore, was not the machine armoured? The answer is simple: in flying, seeing that the planes of an aircraft will only bear aloft a certain limited load, it is the aim to reduce, in every reasonable way, the weight that must be carried through the air. Machines can be armoured; there is no difficulty in that; and craft will ascend, even when their hulls bear the weight of steel plating. But the efficiency of machines, if armoured to any extent, and when driven by such motors as are at present available, is reduced appreciably. What this

means, exactly, is that the speed of an armoured craft is distinctly less than it would be were it not to bear the weight of armouring; while it ascends less rapidly, and is less quickly manœuvred while in flight. And, remembering that speed and ascensional power are vital in a war aeroplane, the drawbacks of armouring are serious, and need to be studied very carefully.

What it was decided to do after the outbreak of war—and after a number of cases had been recorded in which bullets had struck up through the floor-boards of the hull and wounded an airman as he sat at his levers—was to place a very light but extremely tough sheet of steel plating immediately beneath the seats occupied by the pilot and the observer, and so protect them from any direct hit from below, without burdening the aircraft with a heavy weight of armour. And this safeguard has proved a wise one—particularly when, in delivering say a point-blank attack against railway communications or supply depots, an airman has had to sweep down into a zone of rifle fire.

X

It is not always that the airman, while flying on his mission overhead, is content to remain a passive target, and allow gunners on the earth to fire at him without fear of retaliation. Usually, though, seeing that he is on some urgent task, and must not waste time or risk his craft in any duel with those on the ground, he needs to fly on grimly through the zones of fire, and content himself with making his machine as difficult a

target as he can. But occasionally, should conditions favour him, the airman may turn the tables upon his adversaries on the ground; and one of the strangest incidents of the war, so far as aircraft and gunfire are concerned, was an engagement that took place near Bruges, according to an unofficial report, between a French biplane and a German armoured car which carried an anti-aircraft gun.

The armoured car, moving along a flat, open road, came within sight of the aeroplane and stopped, its gunner opening fire promptly. The biplane was a large, powerful machine, and carried, in addition to its pilot, a passenger who was armed with a small machine-gun. This fact emboldened the occupants of the aeroplane, when they noted the exposed section of road on which the armoured car had halted, and the fact that the Germans had no other guns in sight, to descend to a lower altitude and deliver a counter-attack. The pilot, a skilled flyer, swung sideways at first so as to take his craft temporarily out of range; then, making a quick half-turn and diving until he was near the ground, he drove his machine straight towards the armoured car, and at a speed of seventy miles an hour.

The occupants of the car were disconcerted by this manœuvre. The last thing they had expected was an attack from the aeroplane—which was moving at such a pace, and was drawing in on them so quickly, that they had no time to get their car in motion, whatever might have been their wish. The gunner, turning his weapon against the approaching aircraft, did his best to hit it with a shell; but the target offered was

extremely small, and he made bad practice. Meanwhile the biplane was closing in very rapidly, and the passenger, operating his machine-gun, began to pour a stream of lead against his antagonists below. The car, though it was armoured, was protected only against attack from the earth, its occupants being exposed completely to the bullets that began to rain on them from the air. Some replied to the aerial gunner with their rifles, but this was ineffective; and in a moment or so, leaping from their car and abandoning it, they were in full retreat towards some trees that offered shelter. But the aeroplane, its machine-gun still rattling, was now at a very short range; and two of the car's crew fell dead, and two more were wounded, before the shelter of the trees was gained.

And then the biplane, undamaged, rose again to a high altitude and continued its flight.

STUNT FLYING

BY T. J. C. MARTYN

NOW that the open season for flying has begun, the average man on the ground—especially one who has watched the sea gulls glide effortlessly through the air, turning sharp angles, swooping suddenly to the water and soaring up again—may occasionally see the stunting of an airplane and decide that it looks rather clumsy. If he be watching from the bottom of one of Manhattan's yawning chasms a plane looping high in the heavens, he will naturally miss much of the movement and beauty of it; but if he be looking from the terra firma of an airport at a machine stunting near the ground—zooming over trees or flying between hangars—he will catch some of the breathless excitement of the swift and perilous manœuvres.

Instruction in stunting outside the army and navy is beginning in the commercial flying schools. At the Roosevelt Field Flying School and at the Curtiss School all pilots are now required to put the machine into a spin and pull it out, before they can go on their first solos. This, though but a step in the right direction, is one the importance of which cannot be too highly emphasized; for a thorough knowledge of aërial acro-

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batics is almost certainly going to be the most valuable that a commercial pilot can acquire.

Stunts, so called, may be divided into two categories—the foolish and the useful. The foolish ones are those done close to the ground; for no matter how expert a pilot is it is only a matter of time before a slight error of judgment will cost him his life, or at best a serious accident. The useful stunts, such as looping, spinning, rolling, Immelmann turns, &c., were developed in the wartime exigencies of pursuit flying and are performed, usually at a safe height—that is, at an altitude sufficient to enable the pilot to right his machine without running the risk of a crash. But to the ground observer, stunts may seem quite unnecessary in this day and age of commercial aviation.

This, however, is not the case. Stunt flying is every bit as much of a science as, for example, aerodynamics. There is a wrong way and a right way to loop; one way can strain the machine seriously; the other will put no more strain on it than it will normally encounter riding through rough weather. Moreover, although stunt flying is usually supposed to relate to air fighting, it has a definite peace-time value; the pilot who knows how to stunt, how to get his machine into every conceivable position and difficulty and how to get it out again, is the one who is the most to be trusted with the lives of passengers and the one who is never likely to be caught unawares in one of those sudden, dangerous situations that all pilots sooner or later experience. He knows what to do in almost every crisis and he knows it because his judgment has been formed and tested in the arduous school of scientific stunt flying.

Suppose you are a ground observer, and accompany an instructor of stunt flying. Perhaps you learned to fly years ago; perhaps you have flown several hundred hours in the mail service; it makes no difference. You will be treated as a novice whether the object is a thrill or to qualify for passenger or pursuit flying—a test that ought universally to be applied but at present is not. On reaching a height of two or three thousand feet you will experience nothing more exciting than learning how to fly straight and you will be shown the effects of too much right or left rudder or too much right or left bank.

That is easy. Next come turns to the right and left, and as you improve the turns become steeper and steeper until they are vertical. In a vertical turn an extraordinary thing happens. The rudder becomes the elevator and the elevator, the rudder. In fact, the more a plane is inclined laterally the more the controls change places, so that each turn at a different degree of bank is different, and the difference is detected by feel, or in instrument flying by the indicators on the pilot's dashboard. But when you have progressed to the vertical bank stage the instructor will suddenly kick on top rudder; the plane stalls and goes into a spin.

Then comes the quiet voice of the instructor over the telephone: "Switch off the engine. Push the stick forward. Centralize the rudder bar." And in a moment the plane is flying on an even keel. There is no hurry, no excitement (except, perhaps, to an embryo airman), for there is no danger.

Landings will be the next and longest lesson of all. When you have been taught to judge distances you will be permitted

to land straight into the wind. The next thing that will probably happen is to have the engine cut out when the plane is vertically above the airport at a height of, say, 1,000 feet. The instructor has purposely cut the engine out and is telling you to land on the airdrome. That will be your first lesson in spiraling—losing height by circling down, either in one direction or alternately to the right and left—and one way or another you will have to get into the airdrome.

Spot landings—landings on a mark on the ground—and cross-wind landings follow. The latter are done by side-slipping into the wind and landing on one wheel, immediately after turning into the wind—the most difficult of all landings. These are necessary for forced landings in which a head-to-wind landing is impossible for lack of time or space.

You can now fly straight, turn in both directions at any angle, land regardless of the wind on a mark on the airport. You are now ready to learn stunting. The instructor no longer shows you how to do anything; he merely directs you and never comes to your assistance, other than verbally, unless it is absolutely necessary to avoid a crash. When the plane is soaring about 3,000 feet up, his voice will come over the plane telephone: "Put your nose down to 90 (or whatever the speed is for your particular plane). Keep the rudder bar straight and pull the stick back toward you with a firm movement. When you see the ground, switch off the engine."

You push the stick forward and the plane gathers speed, and when the air speed indicator shows 90 you will pull the stick back as far as it will go. The plane rises swiftly, the earth

disappears as if it had suddenly shot off from under you and you are conscious of a vast expanse of sky and clouds rushing down to meet you, and the next moment the earth is directly below you. If this is your first loop you are probably so excited that you have forgotten to switch off the engine and the plane begins to tear down at a terrific speed. In a moment the instructor's voice is calmly telling you, "Off with the engine." Your first loop is over.

In some ways a loop is the easiest of all the stunts and after you have done twenty or so of them they cease to yield any thrills. But at some time or other the instructor will almost certainly wait until you are about one-third up on a loop and then cut the engine out. He wants to see if you will keep your head. The plane, deprived of its power, does not have speed enough to complete the loop and stalls; that is, for an infinitesimal second it hangs in the air and then either whips over and goes down in a spin or begins to tail slide (go down tail first), from which position it may go into a tail spin, giving a most uncomfortable feeling to the novice. If you know what to do and do it the instructor will remain silent; if you lose your head his voice will soon calm you and instruct you in what you should be doing. And within a minute the plane will be once more sailing on a level keel.

On another occasion the instructor will wait until you are on top of a loop and suddenly kick on right or left rudder with the result that the plane falls out of the curve sideways and rapidly goes into a spin unless you take immediate steps to counteract it. But by this time you are getting hardened to

surprises of this kind and have control of the plane every minute.

So the times comes when you are taught to roll—a side loop executed by putting on sharp rudder and bank one after the other and then pulling the stick back. In a training dual-control plane the movement is slow and cumbersome, but in a fast pursuit plane, which you will shortly fly, the machine whips over in the twinkling of an eye and may even go over twice before you can stop it, after which it stalls into a spin. In fact, a spin is usually the way out of all uncontrolled stunts, but as the spin is easily stopped there is never cause for alarm.

Next comes the Immelmann turn, invented by the famous German war ace. It is merely a sideslip from a stall and has the advantage of bringing the plane around in the opposite direction to which it was going. There is the tail spin, one of the most difficult of stunts. Some machines will not do it and invariably complete the initial stall into which it is normally necessary to put the plane. You perform the stunt by getting the machine to slide backward and then putting on opposite bank and rudder, as in a forward spin. To get out of it you straighten out the rudder bar and bring the stick to the centre of the cockpit but not backward or forward until the spin stops, when you pull it back to cause a stall.

The falling leaf is perhaps the most difficult stunt, with the exception of an outside loop—one in which the plane is dived down on its back and climbed out to the top. What makes the falling leaf so difficult is that the plane has to be stalled, with the engine off, in a horizontal position; that is, flying level with

as little forward speed as possible. In this position the plane is balanced laterally as if on the edge of a razor and the successful completion of the stunt calls for exceptional skill.

As soon as the plane is brought to a halt you push the stick over to one side sharply and at the same time kick on the rudder. The controls are limp and it feels as if nothing much has happened, but the machine heels over to one side. As soon as it does you have to bring the controls over to the other side and the plane should recover and list over to the opposite side. The effect is that of a leaf falling through the air, swinging first in one direction and then in the other. The great difficulty is in keeping the nose of the plane up and in preventing it from falling too far over to one side.

All through this stunting period you will be practicing forced landings. You will find yourself coming out of a spin. You open the throttle but the engine is "dead." The instructor tells you to pick out a field and land on it. This you do. One day, when you are getting fairly expert, you will be taking off from the airport and at about 300 feet up your engine will cut out. Man's normal instinct is to try to turn and get back on the air-drome, but this is almost invariably fatal. Possibly more deaths in the air have been caused by this foolishness than by anything else.

The only thing to be done is to go straight ahead and make the best landing possible, and as you have by this time been taught to land on a pocket handkerchief you should find no difficulty in making this extremely difficult forced landing. It is, however, the one test in which the instructor will not stop to

instruct you; if you do not do the right thing right away, he will, and if you "freeze" on to the stick you will probably get a swift knock over the head with a heavy stick that the instructor keeps by him for such dangerous pupils.

Solo is child's play. In reality you have flown the machine yourself for perhaps fifty hours. You can loop, spin and roll as easily as turn. You are thoroughly airbroken. Then when your chest is puffed out to its maximum, your instructor will suggest some more dual-control. He wants to make sure that you are doing everything in the way he taught you. So up you go and are put through your paces, so to speak. As usual he will surprise you with engine failure in an awkward moment, only this time he will indicate a field for you to land in. It is the prize field of all. It probably has high trees around it, a high fence between them on one side and high bushes between them on all the others, and the field itself is about half an acre or less.

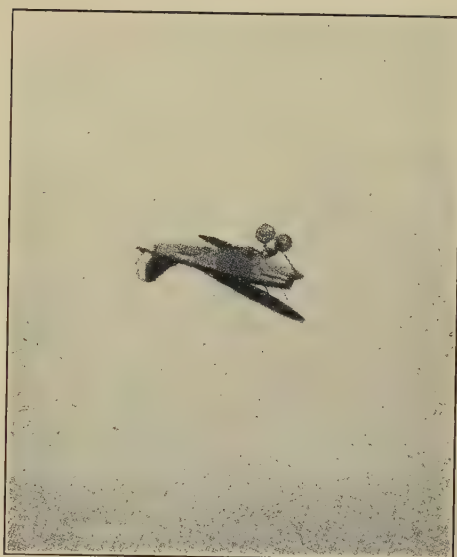
You will not, if you are smart, bother about the wind, and will circle around the field. Seeing a gap in between the trees, you will make for it. Your wheels have to scrape the tops of the low bushes and you will have to make a "pancake" landing, one with no forward speed. This done, you will have to get out of the field again, which is almost as difficult as getting into it. If you are successful you can be assured that you will be passed as a first-class pilot; for the field has been artificially created, in all probability, so that only an expert pilot can get into it and take off from it.

Since the scientific knowledge of stunting—knowing how

much each control does and why—makes for safe flying, the observer on the ground should feel assured that in this way pilots are training for the day when they will take him from New York to San Francisco, and he may be further assured that no matter what ills befall the plane en route his life will be as safe in their keeping as it is in the hands of a locomotive engineer.



The Barrel Roll



Top of the Loop

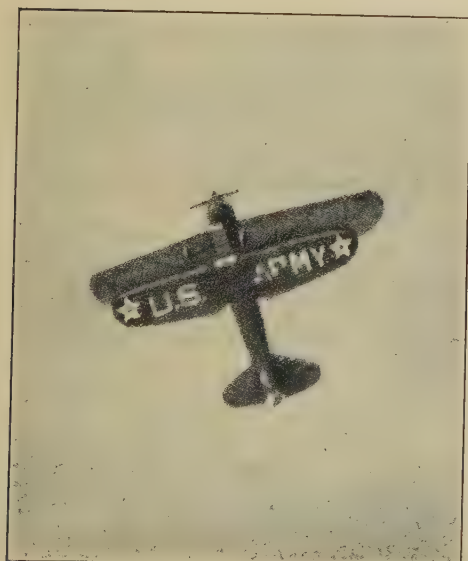
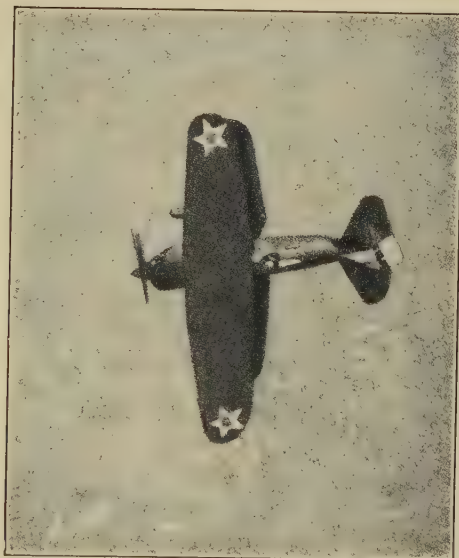


PHOTO BY U. S. ARMY AIR CORPS

Another View of the Roll



The Immelmann Turn

HOW TUBBY SLOCUM BROKE HIS LEG

BY JAMES WARNER BELLAH

THE flying man's god," says "Hell's Bells" O'Neil, "is more powerful than dynamite. Call him what you like, but, always remember that he's got his tongue in his cheek and his thumb half-way to his nose—and never light three on a match.

"Tubby Slocum was seventeen when he joined up. He had a hard time getting in on account of his lines which were more or less on the order of a bloated blimp—but a Turkish bath steamed his blubber off enough for him to pass and in he came. At his training 'drome they called him Crashing Tubby Slocum. If there was a forced landing to be made, he made it on a hangar roof, or a greenhouse or in a lake. He always cracked his 'buses to splinters when he cracked 'em at all, and he never even got bruised. There was only one tree near that 'drome and he pancaked into it three times in Jennies. Couldn't get by it, it seemed. They almost fired him out altogether for mounting up the war debt. But he stuck it somehow and got through his training days without even ripping his pants.

"Everybody shook his hand and told him to save a place in hell for them, because the way he had hard luck looked like he'd get the first wooden kimono in the crowd.

By permission of the *Aero Digest*—N. Y.

"Well, the first thing he done at the war was to smack himself plumb into a chimney one evening in a fog. He was lost, 'way behind our own lines. The chimney shears off his port wings as easy as cutting cake, and the Camel ricochets like a drunken mule driver into a nearby treetop and lands as softly as you please. Whereupon Tubby climbs out, wipes his nose and says 'Hell!'

"Was little Tubby hurt? You can just bet he wasn't.

"About three weeks later, I was flying with him on early morning escort. We'd seen a couple of Huns and got ourselves shot at, but nothing serious came of it. About ten minutes later, Tubby starts down. I stand by him but he waves 'No good' and keeps going down. It looks like he's got a bullet in his tank and the gas is gone. We were about twenty or thirty miles in, and God knows where our bombers had got to, and we weren't worrying. Down goes Tubby and the last I see of him, he's picked his field and landed. I felt pretty bad about it so I circled around a bit. He climbed out of his 'bus and waved good-bye to me. I hated to let him go that way, but that's what they paid him for, so I waves him 'pip pip' and beat it before an 'archie' party opened up on me. When I got back to the 'drome, there was Tubby on the tarmac. You could've knocked me down with a blackjack. He'd stood around waiting to be taken prisoner, and when no Jerries came out for him, he fiddles a bit with his motor, gives the prop a flip and she starts again. So he hops in and comes home.

"The next thing that happens to him is that he comes in to the 'drome out of gas and cross-wind, making pretty nearly a

hundred and twenty-five by the time he gets close to the floor. He can't sit her down, so he hops some tree stumps that used to be a forest, goes into the next county, skidding to the left, and smacks into the far lip of a shell-hole. The left skid tears his motor off sideways, away from him. All four longerons break and Tubby, still strapped to his seat, takes a flying loop out of the wreck and lands in the next shell-hole up to his ears in mud. Hurt? Not Tubby.

"Then there was the time the Huns came over on a night Gotha raid to get the hospital that was near us. They drop more eggs than an orphan asylum has on Easter morning. It looks like the end of the world to me. We all bolted for our funk holes to wait 'till the reception was over and most of us slept in tin hats. But not Tubby. He was drunk and asleep in his hut, and a sixteen-pound bomb smashed through the roof and the floor and covered him with wood splinters. Hurt? Hell, no! It was a dud.

"Well, one thing and another, and never a scratch on Tubby. If his guns jammed in a fight, all the Huns' guns would jam too. If he got a burst of twenty in his control wires, one strand would hold out until he landed. I remember once—you may recall it—they still talk about it when the bottles are full. He'd lost his left wheel taking off from a 'drome up near the Ypres-Menin Road—smashed it ballywest on a horse carcass, or a stump or something. He knew it was gone, but he had a job to do, so he did it. They got him in the motor and his prop froze at about sixteen thousand. He dove out of the fight and flopped down to let 'em think he was done in. Got clean away

and tried to make the 'drome, but he'd lost so much height he had to land near a battery of heavies. There wasn't much room and there wasn't anything to wedge his wings between, so he side-slipped and tried to pancake. The broken wheel caught in something and pirouetted him around about six times, and he landed smack on the ammunition dump. The gunners did a getaway in something under nothing flat. Half-a-dozen shells were knocked about like tenpins. When the gunners came back, there was Tubby sitting on one of them lighting a cigarette. Not a scratch on him—and he'd had four Cooper sixteen-pound bombs in his rack when he hit! Luck? My God!

"One night we were roaring back to work after a night in Busigny. We were red-eyed drunk and couldn't find the road. We'd gotten around to 'The Captain has the Croix de Guerre, parley-voo!' in bar-room tenor, when the car takes a neat Immelman, does a split-air turn and plops athwart a crater upside down. I clawed the mud and half a dead horse outa my mouth, and calls the roll. We're all there but Tubby. We poked round in the debris that someone who had been fighting a war had left, but we can't find him anywhere. Then I give a yell for him and I hear his voice, sort of muffled like, say, 'Lemmelone—umtakinbath.' There he was under the car, up to his chin in shell-hole syrup. If there'd of been an inch less space he'd of been drowned. But not Tubby. Safe and sound he was, without a scratch.

"The cards wasn't right, you see," says "Hell's Bells," "so the flying man's god let it pass. Then one day he raised his

thumb to his nose and wiggled his fingers. The way of it was this. The Armistice was fought and won, and the squadron was ordered to Marquis to turn in the ships and report to the repatriation camp at Shornecliffe. Tubby was listed as a student in civil life, and he had a cousin in the Air Ministry who got him special embarkation orders. He was to go direct to Southampton and back to God's Country, traveling like a general. He was to meet his 'Sweet and Only' at the dock, and marry her before his stuff got through Customs. He was all het up over it. Said he'd give a farewell supper in Paris. Took us all down and set us up royally. By the time we'd got to the point of drinking the champagne from the champagne cooler, he decided to have a toast. 'Beslilolesquarronworld!' he toasts, drinks his drink, sits half in and half out of his chair, chair tips over—crashes—and Tubby yells blue murder. We pick him up and I'm a son of a gun if his leg wasn't broken in two places just below the knee!

"He spent three months at a Frog hospital in a plaster cast, missed his boat home, spent four more months at Shornecliffe, waiting for that damned, concrete-bottomed tub they called the *Canada* and got a wedding invitation from his girl just before he sailed!"

LINDBERGH'S START FOR PARIS

BY JESSIE E. HORSFALL

WHEN Lindbergh came down from his room into the lobby of the hotel at 2:15 on the morning of the flight, he said:

"Don't pass the word around because I am not sure I am going until I get further weather reports."

He was the least excited person in the lobby.

We had become well acquainted with him during the days of waiting after his record-breaking flight eight days before from San Diego to New York.

He got into our car and we took him to the hangar on the field through rain and absolute darkness. Probably 5,000 aviation enthusiasts were on the field despite the dreary weather.

During these crucial hours his manner was perfectly normal, his hand entirely steady, his expression wholly unexcited.

He had had little sleep but he refused the "shot" of caffeine which the doctors offered; he even declined a cup of coffee before he got into his plane to hop off.

"I need no drugs to keep me awake," was his very simple comment, a part of that supreme self-confidence with which he deeply impressed everyone, not only during the slow days

of waiting for favorable weather but during the final moments prior to his departure.

He took with him five sandwiches and two canteens of water. His friend from St. Louis, Mr. George J. Stumpf, representing the St. Louis backers of the enterprise, laid these supplies in the cockpit carefully so that contamination by oil or gas would be unlikely. Lindbergh said of the sandwiches:

"They will be enough for me if I get to Paris and if I don't get there they will be more than enough."

His further luggage consisted of a small white canvas dunnage bag—exactly like a mammoth tobacco sack—containing his maps and weather charts, a hunting knife and fishing tackle.

He was dressed in an immaculate flying suit consisting of a tannish grey cloth lumber jacket shirt with a wide collar which in time of need could be turned up. Underneath this was a conventional soft white shirt, with a collar and dark tie. The two pockets of his outer shirt held a fountain pen and two handkerchiefs. He wore grey Bedford cord knickers, grey golf stockings and high tan shoes. Not a grease spot was visible. His mother calls him a neat person, saying that he could clean a motor in evening dress without getting spots on his shirt front.

His silver watch had been in his pocket during four parachute jumps which he had been compelled to make in order to save his life. But in the Lindbergh estimation it was merely his watch, not a lucky charm.

A spectator commented: "Isn't he clean looking!"

A real characterization. Lindbergh looks and is mentally, morally and physically clean.

When we reached the field Neon beacon lights cast their red flashes upon the crowd but even this picturesque, unusual scene didn't distract the aviator's attention. Partly because of the crowd but mostly because of the lad's modesty, we drove to the back of his hangar. He didn't want to be hurrahed.

The patient, waiting spectators did not catch sight of him until we stopped in front of the door from which the silver nose of the "Spirit of St. Louis" gleamed in marked contrast to the surrounding velvety darkness. Then Lindbergh stepped out of the car and made a bee-line for the hangar door behind which waited his beloved ship which meant so much to him and the cause of aviation.

Immediately he had gone in to her; unseen hands closed the doors of the modest shelter which in its simplicity and unpretentiousness was in such marked contrast to the larger and elaborately painted and decorated house of the "America," Commander Byrd's transatlantic plane.

Lindbergh's hangar in its noteworthy aspects already had suggested to me the descriptive term, Air Livery, for besides the "Spirit of St. Louis" two Orioles and a Waco were also stored there. But to these that particular night meant nothing. To Lindbergh's silvery steed it meant defiance of fate with death or glory at the end of the gesture.

He examined his plane with calm, careful, expert eyes. Perhaps he put an affectionate hand upon its side as a man might touch a horse about to undergo epochal strain, but if so, we didn't see him. His mind was not occupied by sentiment, but concentrated upon the weather reports, which Brice Golds-

borough, the Pioneer Aircraft instrument specialist and navigator, who was his meteorological advisor, had waiting for him.

He went into the tiny store-room of the hangar where, sitting on a keg of nuts and bolts and mechanical miscellany, he studied the weather reports intently.

Presently, perhaps, the thought came to him that many hours were before him during which he would have no choice but to remain seated, unable to stretch those long legs of his, for he rose, completing his checking of the weather data standing.

Lindbergh found these moments full of satisfaction. The reports revealed almost precisely such an atmospheric situation as he previously had declared would be ideal. The only unfavorable detail was the presence of fog off the Banks of Newfoundland which was likely to clear a little as the flight progressed:

"I'll go," he said.

Note that I don't put an exclamation point after the word "go." It was not an exclamation but as if he had remarked that he would cross the street. No watcher ignorant of the circumstances could have dreamed that the two words meant that he would dare alone nearly 3,000 miles of sea.

Quiet within the hangar but for the tunking of the rain on the tin roof. The showers were indicated as local and therefore troubled the young aviator not at all. But another detail had its disconcerting aspect—the field would be soft and muddy, complicating the take-off.

The plane was turned in the hangar and taken out tail first.

The Curtiss Field flood light fell upon the little ship and with

the flares made high-lights bright as day, shadows very black.

Lindbergh in the littered stockroom waited for more weather reports.

The crowd went wild as the plane was moved out of the hangar—proof to them that he was to start. Police on roaring motorcycles fought to herd the crowd back from the area which had to be kept clear.

A strange crowd. Of course many in it were technically interested and informed, but the general public was there too. Cars by the hundreds had concentrated on this especial bit of ground, from New York, all parts of Long Island, everywhere. Among their passengers were people of all sorts. Gotham's night clubs were as fully represented as the air clan, for it was a thrilling entertainment, a great human episode, as well as a tremendous scientific moment. Small boys had haunted the field for days and nights. Long before one lad had confided to us his mother's decision that he could not come out that night. We understood the dreadful disappointment which would agonize his boyish heart if Lindbergh got away when his worshipful eyes were not at hand to see the sight. I telephoned him and his mother let him come, bringing this message for the Captain: "Our whole family is praying for you."

No crowd ever gathered amidst circumstances more disheartening. The uneven surface of the field was dotted with a multitude of pools; some deep, some shallow. The buzz of conversation, the bursts of laughter, the sudden silences now and then were punctuated by the splashes of unfortunates. One heard little screams from women as they stepped into deep, over-slipper puddles.

But only murmurs of outer sounds crept into the hangar where the atmosphere was dank, damp, unpleasant. Stale gasoline. The grooms were working on the flying horse which Lindbergh was to ride that morning. The oil made a curious tunking sound as it was poured into the tank behind the engine. Not a word from Lindbergh. But he was not silent—while they filled the oil tank he walked up and down the hangar with his hands deep in his pockets, whistling cheerfully. It was as if the thing were commonplace.

Many strong hands were ready to raise the plane's tail onto a truck which backed into position. The tail skid was carefully secured. Lindbergh emerged from the gloom within the hangar to watch this process with that careful interest which characterized his scrutiny of every detail of procedure.

Lindbergh did not go with his plane. When the plane had been started toward Roosevelt Field, a mile away, he went back into the hangar to study a weather chart newly arrived from the office of the *New York Times*.

Having absorbed the message of this chart he went to a side door and cast a weather eye up at the sky. The rain poured steadily; the southeastern sky which he could see showed the grey advance light of a sullen dawn.

The men with the plane had their own troubles. The truck wheels cut deep into the saturated earth; now and then the vehicle bumped into ruts, the water splashing on the few permitted to participate in the procession. Stern, official arms outstretched and harsh authority forbade the curious crowd to follow.

Motor-cycles flanked each side of the strange almost funereal cortege. The little silvery "Spirit of St. Louis," dragged backward through the mud, seemed humiliated. It was rough treatment for an instrument designed to undertake in a few hours so tremendous an adventure.

The time came for the calm-eyed Lindbergh to follow the machine on which his life soon would depend. For the journey of the mile he had his choice between a Lincoln and a flivver. He chose the flivver. Lindbergh again. We followed in the Lincoln.

The dawn-grey lightened morosely.

A spectator watching the procession from a short distance saw the plane blend so perfectly into the grey sky that for many minutes he doubted if the machine was there. It took sharp eyes to make sure.

Now and then along the line of the procession a flashlight flared as some cameraman made one more picture for his paper. The balloons of smoke left by these explosions trended lazily away in dense formation which there was not wind enough to dissipate.

Presently the plane came to a halt and stood in bold relief upon a rise against the sky. There was a significance in this particular place, noteworthy to us. It had been the elevation from which the big Sikorsky had crashed as Rene Fonck had tried to take off last September. That tragic episode came to our minds but I know that Lindbergh was not thinking back toward last September and another man's disaster, but was thinking forward to the day after to-morrow and his own triumph.

Alongside Lindbergh's ship appeared the gasoline truck which had been held nearby in position several days. The barrel-shaped metallic drums were in the careful charge of Mr. B. F. Mahoney, president of the Ryan Airlines, Inc., which manufactured the "Spirit of St. Louis." The fuel from the drums was poured into 5-gallon milk cans by workers tremendously deliberate, like figures in a slow-motion picture.

Lindbergh!

Lindbergh's coolness during this to me slow torture again characterized his personality. Speaking to no one he sat in his car or stood beside the gas truck with his lips pursed as if he were whistling noiselessly. I stood six feet from him. There was no sound.

Immense care was exercised to prevent any dropping of the fuel into the cockpit and the fuselage where gas fumes later might have troubled the flyer.

Why on this supreme mechanical occasion this archaic method of filling cans from the drums and then filling the plane's tanks from the cans when close at hand were highly perfected gas pumps? No flivver which brought out to the field that early morning the least important of the spectators had had its tank filled by so crude a method. Not only crude but cruel, because it held Lindbergh waiting for three dreary hours with what many thought was certain death ahead. Many of us were thinking: "If he had had these hours for sleep!"

Still Lindbergh was Lindbergh.

A man stepped out of the crowd, approaching him. His presence at that particular moment was dramatic. With pleas-

ant and fraternal courtesy Commander Byrd of the "America" asked his rival flyer if while he was fueling he would mind if the "America" made use of the runway in taking off for a trial flight.

"Not a bit," said Lindbergh, grinning.

Soon the "America" roared down the runway, passed the Lindbergh plane and headed away on its trial run. The rival plane sailed almost over Lindbergh's head.

When the last gallon of gas had been poured into the tanks of the "Spirit of St. Louis" Lindbergh walked toward his ship, his hands deep in his pockets, his stride as free and unconcerned as if he had been going for breakfast.

His critical, minutely expert, but all-seeing gaze was like that of a man who saw that plane for the first time. The outside world did not exist for him. He was alone in the universe with his little silver airplane. Lindbergh's absorption in whatever at a particular moment he happens to be doing, always is complete.

Out of the sidelines rose a loud chorus from the photographers who wished for one more pose. They all called him "Slim." He didn't resent this, but it bored him. It was as if his calm, clear, thoughtful eyes said:

"All right, but hurry. I have something else to do."

He had. He had to fly across the ocean.

The clicking of the cameramen's instruments was plainly audible. By this time the grey murk of the dawn had given place to the clear light of a grey morning.

The recording barograph was sealed, a customary preliminary to all flights where records are to be attempted.

Commander Byrd returned from his trial spin, and gave Lindbergh a fine greeting—one sportsman to another. "Good Luck to you, old man; see you in Paris." It came from Byrd's heart.

A close observer could not have failed to note frank and perfect admiration in the Commander's eye, as he looked at the stripling. Other celebrities came forward to bid Lindbergh Godspeed: Fokker, Bellanca, Chamberlain, Acosta, Noville and many others.

Now he stepped into his flying suit, with Mahoney acting as his valet.

There was a spatter of applause.

Lindbergh, the clean, with a bit of waste wiped from one hand a spot of oil.

The spatter of applause continued. Lindbergh turned to his plane as if to look for something in the cockpit, but really, I think, to hide embarrassment. The seclusion that the cockpit gave his face apparently was grateful for he held his head thus for a moment. Then he tacked his sheet of compass deviations to the instrument board for ready references.

Workmen now grasped the "Spirit of St. Louis" by the tail and leveled her so that the gas would flow into the feed pipes ready for the tuning up. Her tail was lowered then as gingerly as if it had been charged with dynamite or made of glass. A mechanic climbed into the cockpit and tested the fuel control stop-cocks. A quarter-inch stream of gasoline ran from the pipe through the bottom of the plane, making a tiny pool upon the sodden ground. All okay!

The boy had won the love of everyone with whom he had come into close contact at the field. As Lindbergh prepared to climb into the cockpit Captain Skidmore of the Nassau County Police affectionately put his arm about his shoulders, saying:

"Even if you have to come back, kid, we'll give you a great reception."

Lindbergh grinned again and nodded. Then his long legs took him to and through the small door at the side of the cabin. He is not awkward. He is tall, but every movement of his limbs has a certainty of meaning. There is no waste in anything that Lindbergh does.

He took his place on the wicker seat which he would not leave again until he had swept across the sea. He tried out the controls; observers saw the ailerons upon the wing and the flippers and rudder of the airplane move slightly and attributed that to the pilot's nervousness. But the man who moved them showed no signs of nervousness.

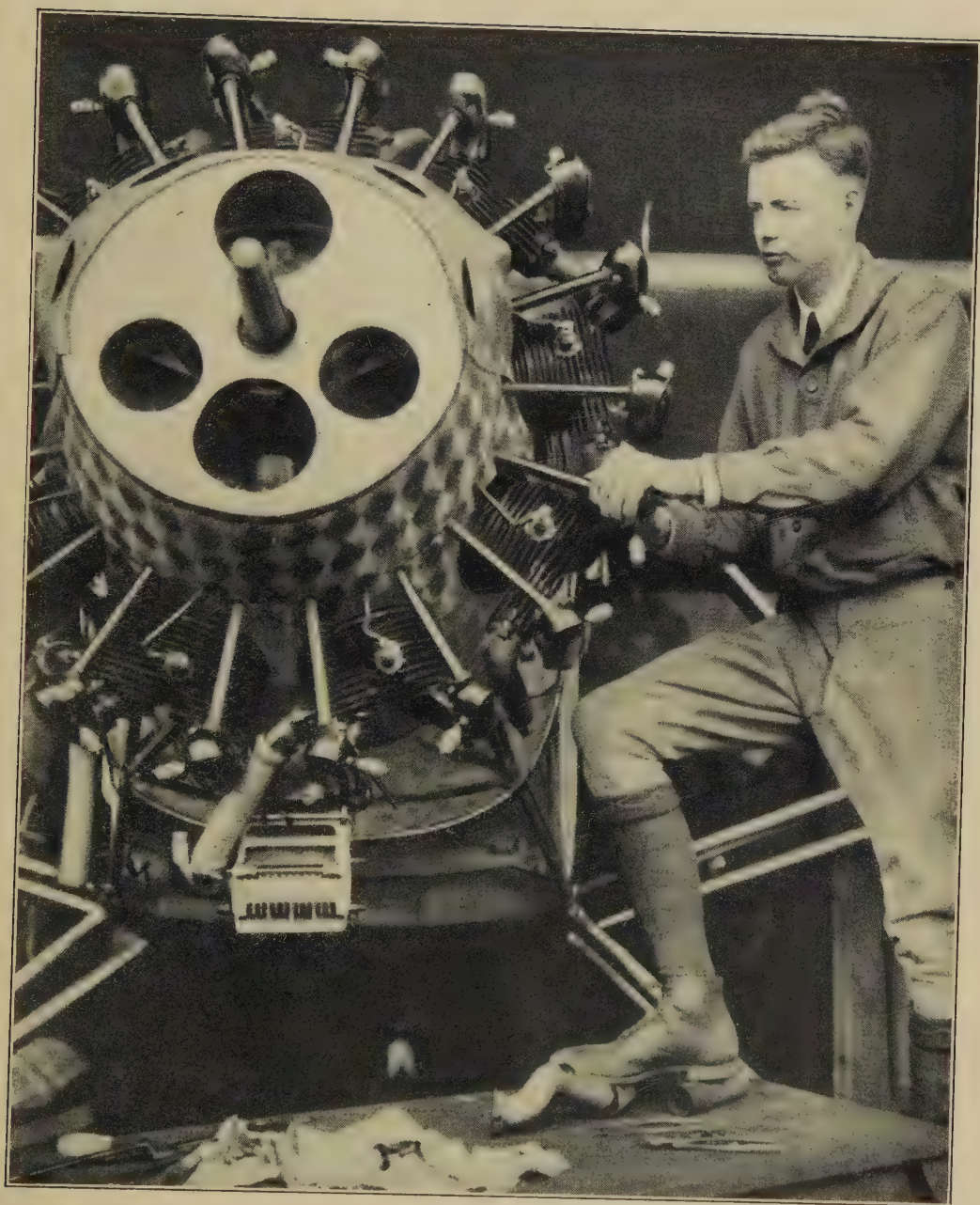
He started the motor which barked and the barking gradually became a roar.

The police on their motorcycles dashed down the runway, their sirens sounding in awe-inspiring chorus as they cleared away the few who had encroached upon the muddy course.

On both sides spectators anxious to see the actual take-off ran along while Lindbergh was revving up the motor after "Spoons" Boedecker had whirled the blade which was to keep whirling over 3,600 miles of land and sea.

Lindbergh beckoned to Boedecker and Ed Mulligan, the engine experts in charge of his motor. They approached. He asked:

"How's she running? Everything all right?"



Tuning-Up for The Flight to Paris

Boedecker later said: "I have tested a good many engines and always wished to say that they were running well, but this time I paused. A lump came in my throat and made it hard for me to say 'O. K.,' but the engine was running sweetly so I said it."

I looked through the side window of the cabin and never have I seen on a human face a look of such determination, of such almost divine courage.

"Well," Lindbergh shouted, with no violation of his usual calm, "Let's go."

Boedecker and his assistant pulled away the chocks and the plane stood trembling for a few seconds as the engine gathered speed.

That plane was alive. The personality of Lindbergh had thrust itself through every fibre. No one ever can tell me that the "Spirit of St. Louis" did not know as well as any of us that it was on its way to Paris!

At exactly 7:51 30 $\frac{1}{5}$ seconds by my stop watch, Friday morning, May 20, the plane began to move, rolling slowly along the runway and gradually gathering speed, the tail skid ploughing a deep rut through the mud. The three tracks left in the ground were evidence of the great weight which Lindbergh was attempting to carry through the air on this unprecedented journey.

The plane had run nearly 2,000 feet before Lindbergh apparently made any effort to put it into the air. Finally the machine left the ground. Ah-h-h!

But the plane only described a graceful arc and bounded

back to the earth, to roll on for a short run before a second attempt. This also failed. Another gasp.

It now seemed to everyone as if it would be impossible to clear the telegraph wires just beyond the edge of the field. Beyond them were trees.

The distorting magic of the mist made the trees, really several hundred yards beyond the runway, seem close to it. They added their threat to that of the wires.

But . . . then——

When all hope seemed gone, with a final bound, the "Spirit of St. Louis" slowly . . . slowly . . . slowly rose into the air.

Actually off the ground to stay, Lindbergh levelled off to gain speed. A moment later, he climbed slowly and steadily to a safe altitude above the trees.

Lindbergh was off on the greatest flight in aviation's history.

The haze was thick. Almost immediately the daring venturer was lost to view.

LINDBERGH TELLS OF HIS TRIP

BY CHARLES A. LINDBERGH

TELLING of his New York to Paris flight in a speech at the luncheon given in his honor by the American Club of Paris, Captain Lindbergh said:

"Gentlemen, I am not going to express my appreciation of the reception I have had here from Paris and the French. I would be unable to do so in words. But I will tell you a little about the flight from New York, and I believe you will be more interested in that than anything I can say, because I am not used to public speaking.

SUCCESS MEANT MUCH

"We first considered this project last fall in St. Louis. We had one of the most successful air races there that has ever been made, so we decided to organize a flight, and at that time the Atlantic flight from New York to Paris seemed to be the greatest achievement we could consider—although there are other projects that would be greater—also because a flight from New York to Paris meant a good deal to us.

"There is no other country after America in which we would rather land than France, and I believe the name of the plane

itself, 'Spirit of St. Louis', was meant to convey a certain meaning to the people of France. I hope it has.

"There was a good deal of consideration of the type of plane to be used in the flight, but the single-motored was considered the best, and the reason for not carrying an observer was that we could carry more gasoline without one. It was impossible to miss the coastline of Europe, but we might have missed the coast of France by a few hundred miles if we had not carried enough fuel.

PRAISES HIS MOTOR

"The order for the plane was placed in San Diego. The motor of this plane is, I consider, one of the best types made in America. The record of the Wright motors is greater than that of any other type.

"After visiting San Diego, I awaited favorable weather conditions in the United States to make the flight to New York. It was during that time the immortal Frenchmen, Nungesser and Coli, left France, and as I have said before, on a much greater flight from France to America, because they were knowingly going into greater difficulties on account of wind and weather than from America to France.

"Unfortunately, they probably met on the western coast with as bad weather conditions as ever existed.

'ALL IN DAY'S WORK

"During four days I was tied up in San Diego awaiting clearer weather to go to New York. Finally we left San Diego

one evening, flying over the mountains during the night, and arrived in St. Louis. Then from St. Louis we went to New York. In New York we were again delayed by weather conditions and it was necessary to check up, but nothing beyond inspection was done to either the motor or the plane.

"The machine had already done 6,200 miles—over 61 hours. I think this demonstrates the reliability of the commercial motor of today and demonstrates also the reliability of planes of modern construction.

"We finally decided to leave New York, upon receiving fairly good weather reports, and after working on the plane and making ready for the flight, we left New York at 7:52 in the morning (Friday, May 20). (Lindbergh habitually refers to himself and his plane as "we.")

"Weather conditions were satisfactory over Newfoundland, but after leaving the coast it was necessary to fly over 10,000 feet because of sleet.

PLOWED THROUGH FOG

"Then at night we flew over 6,000 to 10,000 feet, but in the daytime we plowed through the fog. We finally picked up a course definitely about three miles north of the point on the west coast of Ireland which we had hoped to reach.

"I want to say that the fact that we came within three miles of that point was an accident. Had it been 25 miles, it might have been navigation.

"During the entire trip, I saw no ship at any time. The first trace of a human being was a small fishing boat, prob-

ably 50 miles from Ireland. Several hours after leaving Newfoundland I saw the lights of one boat. There were large ice fields.

"My time is very short now and I believe I will be unable to tell you more of my flight at present. I hope I haven't taken up too much of your time as it is."

CHAMBERLIN'S FLIGHT TO GERMANY

Establishing a non-stop distance record of 3,923 miles from Roosevelt Field, New York, to Eisleben, Germany.

BY JESSIE E. HORSFALL.*

AFTER several reported leave-takings from Roosevelt Field, Long Island, New York, the Bellanca monoplane *Columbia*, piloted by Clarence D. Chamberlin actually made its aerial exit on June 4th, and before it again touched terra firma had crossed the Atlantic Ocean and established a new record for sustained flight—3,923 miles.

Chamberlin had as his passenger Charles A. Levine, owner of the plane, who sprang a surprise by climbing into the glass-enclosed cabin at the last minute. Their destination in Europe was not announced, but Chamberlin said that he would fly until every drop of gasoline on board was consumed.

Police arrangements were less efficient than when Lindbergh took off and it was difficult for Chamberlin to obtain a clear space to accomplish his take-off. At his request, two motorcycle policemen started across the field, chasing the crowd before them. His motor well warmed, the Bellanca pilot started immediately in the wake of the officers, but he had gone only about a thousand feet when one of the officers got in his

* By permission of the *Aero Digest*, N. Y.

path and he was forced to bring the *Columbia* to an abrupt stop. However, he skillfully turned the plane about and taxied back to the starting point at the western end of the runway.

After giving the policemen a little more time to clear the way, Chamberlin again opened the throttle of his motor and the plane moved forward, actually leaving the ground within the first thousand feet. Chamberlin kept the ship on the runway until it began plunging up and down like a rocking horse.

Then the ship began to rise and the take-off was officially clocked at 6:05:27 o'clock, Eastern daylight saving time, which was two hours earlier than Lindbergh's take-off. Chamberlin got into the air in a thousand feet less than his predecessor and the *Columbia* carried a load 350 pounds (total weight, 5,500 pounds) heavier than that of the *Spirit of St. Louis*.

Weather conditions for the flight were ideal at the start of the flight. Before they reached the Nova Scotia coast they began to buck head winds and when they got there they were miles off their course and two a half hours behind schedule in covering the first 600 miles. Soon after passing Halifax, however, a sixteen-knot wind got behind the *Columbia* and increased her speed to nearly a hundred miles an hour. At Yarmouth she was flying low and could readily be seen by watchers on the ground. Visibility was so good that Chamberlin could see 50 to 100 miles.

Chamberlin's "running card," Eastern daylight saving time, was as follows, according to reports from various points along his route:

6:05 a. m.—The plane takes off.

8:00 a. m.—Sighted at North Westport, Massachusetts.

8:25 a. m.—Reported over the town of Long Pond, Massachusetts.

12:06 p. m.—Passed over Yarmouth, N. S.

1:10 p.m.—Passed over La Have Harbor, N. S.

1:30 p. m.—Approached Chedabucto Head, N. S.

1:55 p. m.—Passed over Shag Lodge Lighthouse.

3:00 p. m.—Passed over Wedge Island, N. S.

No fog was encountered off the Grand Banks, but after leaving the North American coast at Cape Race, the *Columbia* ran into storms, fog and clouds but had no great difficulty in continuing on its way. At 11:30 a. m., June 5th the *Belanca* monoplane met the *Mauretania*, 360 miles west of the Scilly Islands, and gave its passengers the thrill of a lifetime as it circled low over the ship. Chamberlin calmly surveyed the ship as he made a complete circuit of it, and then headed eastward at terrific speed. Within three minutes the plane was out of sight.

The *Mauretania* passed the *Memphis*, upon which Colonel Lindbergh was returning home, and radioed the battleship the news that the *Columbia* was tearing off another world's record.

Chamberlin flew a modification of the Great Circle route and first sighted land in England, whereas Lindbergh flew very near the Great Circle, and sighted Ireland first.

Late Sunday afternoon they passed over Land's End and Plymouth, England, en route to Germany.

At 11 p. m., Eastern daylight saving time, it was reported that the plane had passed over the airdrome at Dortmund,

Germany, and that Chamberlin had dropped low and called out: "To Berlin! To Berlin!" The aviation police signalled the direction of the Teutonic capital, 260 miles away, and the plane rose again and pointed for its destination.

The ship's gasoline supply was rapidly becoming depleted so that at 05:35 hours, Mid-European time (12:35 a. m., Eastern daylight saving time) a forced landing, due to exhaustion of the gasoline supply, was made near Eisleben, about 110 miles southwest of Berlin and 3,923 miles from Roosevelt Field. Their elapsed non-stop flying time was 42½ hours. The motor was functioning perfectly and, after refueling, the plane again took to the air in an attempt to reach Berlin. Becoming confused in the darkness Chamberlin made another landing, this time at Klinge, a village near Kottbus, Germany, 70 miles southeast of Berlin. Thus, he actually traveled further than if he had gone to Berlin.

The ground was marshy and resulted in the propeller striking the ground and one of the blades was broken off, so that the fliers were compelled to delay their journey until a new propeller could be secured.

The *Columbia* was located by one of the Lufthansa planes from the Tempelhofer Field, at Berlin, just as it was landing in the bog, where it dug its nose in the soft earth.

Police established a guard around the plane and the tired, but uninjured, fliers were taken to a modest hotel for food and rest. The Mayor of Kottbus welcomed the airmen officially and invited them to be the guests of the city.

The fliers reported that their worst air troubles began when

they reached the Irish Sea and that they had to go higher and higher to avoid storms. Over Belgium and Holland much fog was encountered and at one time it looked as if they would have to land regardless of conditions below.

The populace of Kottbus massed itself in front of the hotel where Chamberlin and Levine stopped, and cheered vociferously from time to time for a sight of them. Intermittent showers seemed to have no dampening effect on the spirit of the crowd.

On the day after their arrival, the fliers were made honorary citizens of Kottbus at a special ceremony in the town hall.

As soon as word of their mishap reached Berlin, the civilian Lufthansa organization offered to place its facilities at the disposal of the Americans with transportation to the Tempelhofer airdrome by means of a large plane dispatched for the purpose to Kottbus. Chamberlin, however, felt that if it were at all possible, the trip should be completed in the *Columbia*. A propeller was at once shipped by air from Berlin and, in addition, two wheels, larger than those originally placed on the Bellanca, were supplied so that the take-off from the marshy soil would be facilitated. Mechanics were sent to the scene to make such adjustments as were required and the *Columbia* was able to start once again for Berlin on June 7, the day after they came down at Kottbus.

When they arrived at the German capital they were warmly greeted by the President of Germany, Field Marshall von Hindenburg, who received them at the executive mansion. After congratulating the Americans upon their record-breaking

feat, President von Hindenburg presented each of his visitors with a framed, autographed portrait of himself. He expressed the hope that the flight would aid in bringing the American and German peoples into closer communication. He also sent a message to President Coolidge.

Chamberlin and Levine were accompanied to the Presidential residence by the American Ambassador, Dr. Jacob Gould Schurman. Outside, in the Wilhelmstrasse, a tremendous crowd gave a rousing welcome to the aviators.

Chamberlin was offered \$100,000 to fly back to the United States, but it seems highly improbable that he would elect to make the attempt.

Throughout Berlin the Stars and Stripes were conspicuously displayed, often in company with the German national colors and the Prussian state flag. Numerous dinners and luncheons were scheduled for the aviators and invitations to visit Austria, Italy and other countries poured in.

President Coolidge sent the following message to the men in care of the American Embassy at Berlin: "Congratulations upon your wonderful feat in setting a non-stop record in conquest of the air. Our country rejoices with me in your safety making first sustained flight from America to Germany with our greetings to its people."

Following a week of social activities, the aviators left Berlin by train, on June 13th for Baden Baden, the *Columbia* being in the hands of the mechanics at Tempelhofer Field. At Baden Baden, the flyers were the guests of the Mayor and of Count von Bernstorff, who will be remembered as the German am-

bassador at Washington during the early days of the Great War. Crowds of people acclaimed them.

In the Lufthansa plane, they flew to Friedrichshafen where they visited the Zeppelin works and the plant of the Dornier airplane company.

From Friedrichshafen they went to Stuttgart by plane and were given a formal luncheon. Over one hundred thousand people lined the streets and many pelted the fliers with flowers. At Frankfort, in the evening, they were the guests of the city at an elaborate dinner in the Town Hall. After resting there overnight they went by air to Hanover and thence to Bremen and Bremerhaven. Leaving Bremen, they flew to Hamburg, where they were welcomed by a Senate delegation, and from there to Magdeburg and Berlin.

Hopping from Berlin on June 19th in the repaired Bellanca, Chamberlin and Levine reached Munich that afternoon. They were received by the Lord Mayor, representatives of the Bavarian Ministry, the Aero Club and the American Consul. The City of Munich presented the fliers with the Bavarian colors attached to an American flag and the golden pin of the German touring club. An official honor decoration was also given to them.

They arrived in Vienna at 7:25 in the evening during a heavy rain. High dignitaries of the Austrian Government, city officials and the entire general staff of the Army awaited the aviators in a reserved enclosure at Aspern Field. Outside, thousands of men and women roared a welcome. Both men were presented with diamond-studded medals by the Aero

Club of Austria, and on the following day President Hainisch conferred upon Chamberlin the Austrian Order of Merit in recognition of his great non-stop flight. They are the first Americans to receive the honor for other than distinctly benevolent activities. It is the only decoration conferred by the Austrian Republic on foreigners

Thousands of people made the seven-mile journey to the aerodrome at Aspern last Sunday and from 15,000 to 20,000 of them stood from four to five hours in a steady rain waiting for the *Columbia* to arrive, which it did three hours after the scheduled time. A crowd of several thousand took up a stand in front of their hotel when the fliers entered it after their arrival, and on Thursday afternoon, when Chamberlin and Levine left, it had only dwindled to hundreds. Whenever they went forth they were followed by cheering Viennese.

On June 22nd the transatlantic fliers arrived at Budapest, then returned to Vienna and flew from there, through wind and rain, to Prague, Czechoslovakia, on June 23rd, where they were feted by President Masaryk at Hardschin, Prague's ancient seat of government. The President of the Aero Club, the Mayor and the Secretary of the American Legation were among those who welcomed them. The news of their arrival spread rapidly and soon the streets were filled with the cheering Czechs. The American Minister, Lewis Einstein, gave the airmen a hearty greeting.

Hopping off from Prague the transatlantic fliers landed at Pilsen. After being guests of honor at a luncheon they visited the famous brewery where Pilsener beer is made. They continued their flight that afternoon to Marienbad.

On June 27th the *Columbia* landed at Warsaw and immediately was surrounded by a cheering throng. The fliers were entertained by the Polish-American Association. Leaving Warsaw on June 28th, they flew to Zurich. They visited Berne, Paris and London before they completed their air tour of Europe's leading cities.

BYRD'S FLIGHT OVER THE NORTH POLE

BY FLOYD BENNETT

This is the First Exclusive Story by the Pilot of the Josephine Ford on the North Pole Flight.

OUR expedition left New York April 5th, with a crew of 52 men aboard the *S. S. Chantier*, the 3500-ton steamer supplied to us by the U. S. Shipping Board. We carried two airplanes, a small Curtiss *Oriole*, to be used for finding a suitable landing field for our big three-motor Fokker monoplane, the *Josephine Ford*, which was to carry Commander Byrd and me from Spitzbergen to the North Pole. Our 1500 tons of supplies and equipment was sufficient for a cruise of 10,000 miles.

On the morning of April twenty-ninth we sighted Spitzbergen and at 4:30 that afternoon entered King's Bay where we were met by Lieutenant Ulling of the Norwegian gunboat *Heimdal*. He piloted the *Chantier* to a berth alongside his ship. We had hoped to find the bay solidly frozen over so that we could tie up the *Chantier* alongside the ice barrier and land the *Josephine Ford* with our supplies and make our attempt from the ice as Amundsen had done last year. But the few small floes were

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barely large enough to support the weight of a man. The season was the most advanced in years. We had to devise other plans immediately. To have waited for a place alongside the dock would have delayed us too long, as the *Heimdal* would be coaling there for the next four or five days.

A party, composed of Commander Byrd, "Doc" Kinkaid, Doctor O'Brien, Peterson, Touchette and I went ashore in search of a landing field and base. A large space between the village of King's Bay and the hangar built for the Amundsen-Ellsworth-Noble airship *Norge*, about a mile wide and a mile and one-half long, would give us a runway for the take-off about 600 yards long; it was down grade 5 per cent and as good a landing place as we could hope for. One drawback was that it was a one-way field, and we could not take advantage of the wind in getting off and landing. But there was no other place in the vicinity. Our next problem was to get our equipment ashore. The snow was coming down fast and the bay was freezing over. It was miserable weather. We worked all night in cold slush and sleet that at times obscured everything more than fifteen feet distant. By morning however, the first load, the *Oriole*, had been taken ashore through gathering ice floes, and greeted the inhabitants when they awoke and came to watch us with curiosity which often developed amusement for us all.

We had chopped a runway through the edge of the ice, cutting it down to the level of the pontoon we constructed so we could haul the planes up to the beach, and on these landed the small plane. The work had nearly exhausted the men, so we returned to the ship to sleep.

On the afternoon of the 30th we hoisted the fuselage of the *Josephine Ford* out of the hold and lashed it to a raft alongside the ship. A strong wind was blowing and the bay was filled with drifting ice, so we did not then attempt to place the large wing on the fuselage. We were compelled to keep men on the raft to push away floating ice cakes which would have broken the raft. The following morning, May 1st, was perfectly calm, but the bay was packed with drift ice. Conditions were perfect for hoisting out the big wing and placing and securing it on the fuselage. In about an hour we reached the beach.

The first big job of getting the plane on shore was done. Our two wing motors, gas and other supplies remained to be ferried over, but our success in surmounting obstacles in getting the plane ashore made us regard this as a small job. Two more trips with our ferry and we were through.

Our base camp on the shore was then established. Our plane motors were installed and we had the plane ready for the motor test on May 3rd. We were working under difficult conditions. The temperature was 7 degrees (F) below zero and several of the men had frost-bitten hands and feet. We had worked almost continuously for three days and greatly needed sleep before attempting our test flight. It was difficult for us to sleep with the constant daylight—one could work until nearly exhausted and still not feel the need of sleep. It is an odd sensation to wake at midnight and find the sun shining as at noon.

On May 4th we were ready for the first engine test. The

difficulty of starting our three Wright "Whirlwind" air-cooled engines in the extreme cold had been anticipated before leaving New York. Therefore, for each motor we made a hood or cover of fireproof canvas which fitted snugly around the motor with a funnel-like extension below the motor. Three gasoline stoves with vertical blow torch burners were placed so the heat would be carried through the canvas ducts to the hoods. The heated air thus circulating around the engines warmed them up in a few minutes. The oil tanks were filled with warm oil. After these preparations the motors started as easily as in a temperate climate,—a tribute to our Flight Engineer, Lt. Noville.

We were next ready to try the skis. To my knowledge no plane of this size has ever been started on skis, especially with a useful load of 6000 pounds. I had never flown any plane with skis, and had little knowledge as to how the plane would act. A test flight of at least two hours was decided on before the final start, to give us a chance to see how our motors would function under these severe conditions.

Finally all was ready. One motor was opened. Nothing happened! Two motors were opened and still nothing happened. With the third motor wide open our plane did not move an inch! After considerable effort we finally got the plane moving, taxied away up the hill, and turned around for the trial take-off. Again all motors would not start the plane moving and the crew gathered around to give a lift for a start. Touchette, who was standing near, found a break in the main fitting which secures the landing gear to the fusel-

age. The ship was strong enough for use with wheels, for which it was designed, but when equipped with skis and either of the wing motors used separately there is a terrific strain on the landing gear, because the skis do not turn on the snow as easily as wheels on the ground. It requires a larger space to turn a plane when equipped with skis. We found that a crew of men could not lift the tail of the plane and turn it, as is usual in turning a ship with wheels. It was by attempting this that we broke the first set of skis and landing fittings. We had come prepared for trouble and had an extra landing gear and two extra sets of skis. But it means time and labor to change them on a plane weighing 4000 pounds and in four feet of light snow. It was necessary to dig down through the snow in four places and build a foundation of gasoline drums upon which we could place jacks and raise the plane clear of the landing gear. This was a delicate operation as an increase of wind might have forced the plane off the jacks and the expedition would have reached its end. No plane, no flight.

After fifteen hours of hard work we were again ready to attempt the test flight. Lieutenant Parker and I were at the controls of the big plane and Flight Engineer Noville and Mechanician Peterson in the cabin. It was necessary to make a slight turn to the right as we got under way as we had cleared only a narrow runway and there was a snow bank on the left. The plane did not move until all three motors were opened. Then the left ski stuck slightly and the plane headed to the left instead of to the right, which caused the left ski to catch

and break in a snow bank just as we had nearly cleared it. The plane whirled around and, as the ski broke, plunged her nose into the snow. This experience increased our respect for the snow. We were learning.

One ski was ruined, one landing gear strut broken, and other members of the landing gear were badly bent. The metal propeller of the center motor was out of line and had to be replaced. We were getting quite experienced in jacking up the plane in the snow, but this meant another day's work and delay which was serious. Every day lessened our chances should we have to walk back over the polar sea. The sooner we could get away the less fog we would encounter upon our flight, and naturally we hoped to be the first to reach the pole by air.

On May 5th we were ready for another attempt to get off on our test flight. Everything was set, the motors turning up and it seemed as though every possible precaution was taken. The *Norge* was due the next day and as we were quite close to the entrance of their hangar it would be necessary to move our plane before they could land. Lieutenant Parker and I were in the pilot's cockpit and Lieutenant Noville and Peterson in the cabin. With motors wide open we gained speed as we glided down grade. It looked as though we would make it. Off at last! What a glorious sensation to be in the air after all that work. I wished then that the ship was loaded and headed for the North Pole.

At the end of an hour everything was fine and the motors going great. The temperature and pressures remained constant

and everything looked favorable. Suddenly after about an hour and thirty minutes in the air there was an alarming vibration throughout the plane accompanied by a dull hum. The motors were throttled preparatory to landing when it occurred to me what the trouble might be. The plane was equipped with radio and the small electric generator was mounted on the outside of the fuselage just off the cockpit. I looked out just in time to see the generator torn from its mounting. A portion of it went overboard, the balance hanging on about four feet of wire, Noville and Peterson had seen the generator and by opening a window in the cabin, reached down and pulled it in. We continued our flight for a period of two hours and thirty minutes with no further trouble.

Our first landing on skis was made, which we found not at all difficult, and the plane turned around by hand and headed down grade, where it would start on its history-making flight.

Final examination of plane and motor showed me we had a leaking oil tank on the starboard motor. This we removed and repaired, and a new radio generator was installed. All that remained for us to do was to load the plane with the fuel and equipment and give the motors a final looking over. Our equipment consisted of about three hundred pounds of food, mostly pemmican; two twelve-pound portable rubber boats with paddles; a tent built especially for us; two pairs of snow shoes; a sledge built for us in Spitzbergen; a thirty-caliber Remington rifle and a twelve-gauge shot gun; 300 rounds of rifle ammunition and 200 rounds of shotgun ammunition; an extra parka; two pairs of winter mukluks and two pairs for sum-

mer; an extra pair of reindeer trousers; and a total of 615 gallons of gasoline and 40 gallons of oil (sufficient for a flight of at least twenty hours), 410 gallons of this gasoline was in our tanks and 200 in 5-gallon cans to be emptied through a chamois into the main tanks during flight.

The seventh of May was spent in getting the gear stored in the plane. While this was being done, Peterson and Kin-kaid were carefully inspecting the motors. On May 8th, about 12:30 G. M. T. we were ready for the great adventure. The motors were warmed up and "good byes" were said. I would have preferred to omit the "good byes" as I was not so sure we would get off. The plane was loaded to capacity; our total useful load being 6000 pounds, 500 pounds more than we had taken off with on our test flight at Mitchel Field, New York.

Everything was set to go. Motors opened wide, the plane started slowly down the long runway. We moved along 100 yards before our motors were full out but still I thought we could get off. So we continued down the long runway, our speed gradually increasing until we reached the end of the runway where we had packed the snow. I knew that if we could not clear the snow here there would be no use continuing further, for as soon as we came in contact with the soft snow we would lose speed. At the end of the runway I made a final attempt to get the heavily-laden plane off the snow. It was unsuccessful as we had only about thirty-five miles air speed and it required around forty-five miles to ride with this load. I throttled the motors so as to stop before we reached the open waters of King's Bay, one hundred yards away; when the motors were throttled the plane stopped almost immediately.

We had failed in our first attempt. After all our work and worry we had failed to get off. To say that I was disappointed is putting it lightly. Then I thought of the crew who had worked almost continuously for the past forty-eight hours. They must have sleep and rest before any more work could be done. Every hour was vital to us as the weather was now perfect for our start. Buried as it was in the soft snow it seemed impossible to move the plane with its extremely heavy load without wrecking the landing gear. It was necessary to remove most of the 6,000 pounds of weight and carry it back to the top of the grade for another trial. The crew was tired out and needed sleep and it looked as though it would be some time before we could make another trial. If we could get the plane back to its starting place immediately we could make another attempt at once. Therefore we took out about 1,000 pounds of the load and within half an hour we had the big *Josephine Ford* back to the top of the hill for another start. With the plane back in this position the spirit of the crew rose. They felt there was still a chance. We decided to take out everything that we could possibly spare without greatly decreasing our cruising radius. By taking out various articles we reduced the weight about 450 pounds.

The runway was again smoothed out and the first hundred feet sprinkled with water to form ice which would better support the weight of the plane. The tail of the plane was secured so that the plane would not move until all three motors were developing full power. A line was passed around the tail skid and fixed to the ground, to be cut when our engines reached

their full power. The gas and supplies were restored to the plane and all was in readiness.

The question arose as to whether we should start immediately or get some rest before going on the flight. Commander Byrd and I thought that we should go immediately but Captain Brennan of the *Chantier* insisted that we should get some rest first. We agreed to go to the ship and sleep for four hours. As we started down the runway towards the *Chantier* the Commander said, "Bennett, we ought to go while the weather is good." I answered, "Then let's go now."

We turned and walked back to the plane and gave instructions to have the motors warmed up and made ready. As this would take about two hours, I thought I might get a little sleep while this was being done, so put on my flying suit of reindeer and laid down on the snow to rest. But there was too much on my mind for sleep. I rested for about an hour.

At 12:50 A. M. (G. M. T.) on May 9th we were again in the plane and ready for another start, twelve hours after our first attempt. We had no "good byes" or handshaking this time. We took our places in the plane and when all motors were full out the signal was given to cut the line holding the tail skid. The plane glided smoothly down the long runway, rapidly increasing its speed. It was apparent immediately that this time we would get off. When a little more than half way down the runway we cleared the snow and were actually in the air. What a glorious feeling! After four months of preparation with its many disappointments and uncertainties we were actually started on our flight to the pole.

It was a beautiful morning with the sun comparatively low on the horizon. Our first sixty miles took us along the coast of Spitzbergen and over open water. After this our course was directly north out into the great unknown. We expected to find open water for the first hundred miles off the coast of Spitzbergen but the polar ice pack extended nearly to Danes Island. The edge of the pack was made of large fields of floating ice extending back a few miles before the solid pack was reached. We expected to find a belt of slush ice along the edge of the pack. We were not disappointed in not finding this slush ice for in case of motor failure we would have a better chance to land on the large fields of floating ice than in the small broken slush ice.

I thought we would find the polar sea a mass of broken ice with no chance to land without wrecking our ship. I was surprised at the condition of the ice; it did not appear nearly as rough as I had expected. Running in every direction there were great pressure ridges, from ten to twenty feet high, formed by cakes of ice of all sizes. It was a great network of pressure ridges, but between some of these ridges were fields of comparatively smooth ice. All of this great mass of ice was covered with snow and in many of the fields between the pressure ridges could plainly be seen large blocks of ice projecting out of the snow. Some of the fields which I observed closely seemed smooth and I believe that a plane could land with some chance of rising again. Of course there would be great risk.

I noted the various sizes and shapes of the sections between

the pressure ridges. We saw three open leads of water resembling long winding rivers extending through the ice. Two of these were very narrow, perhaps thirty or forty feet in width. The third was somewhat larger, large enough, I believe, to land a large seaplane in. There seemed to be no great change in the condition of the ice throughout the entire flight. There was an occasional lead that had just recently frozen over, presenting a blue line across the glaring white surface.

Everything went along smoothly for the first six hours, Commander Byrd continually checking our course with his sun compass, taking the drift of the plane, using his sextant to determine our position and taking photographs, both still and motion pictures. He relieved me at the wheel about twenty minutes out of every hour so that I might check up the gas consumption and pour more gas into the tanks from the 40 five-gallon cans. We did not have much time to let our thoughts wander and perhaps it was just as well.

After about seven and one-half hours Commander Byrd reported an oil leak in the starboard motor. From the cabin he had a good view of the wing motors and could see the oil leaking out and covering the cowling and tail section. He came forward and took the controls and I went back into the cabin to see if I could determine the seriousness of the leak. It looked bad and I did not know how long the oil would last. It is not possible to get out to the motor. The oil tank was completely cowled in and covered with asbestos and over this a covering of canvas. Therefore there was no way to determine the position of the leak. If it should be at the bottom

of the tank all of our oil would drain out in a short time and our motor would be useless. I returned to my seat and Commander Byrd asked, "Is it a bad leak?" I wrote on a pad "It is a bad leak and we may lose the motor at any time."

Then we throttled the leaking motor to determine if we could continue with the two remaining motors should we lose this one, and we were able to maintain our altitude of 2,000 with the two motors. I indicated to Commander Byrd that we might land and fix the motor. We decided however to continue the flight to the pole and if necessary to return on two motors.

For the next hour and thirty-five minutes Commander Byrd was busy with his sun compass, sextant, drift indicators and cameras. Suddenly he came forward and shook hands with me. We had reached the pole!

We circled at the pole and then started on our return. The sun was now almost directly in front of us to the left, that is, it passed across the windshield from left to right, and I was able to use it as a check in holding my course. After about six hours on our return course I sighted what I thought to be land but as I was not sure I did not call the Commander's attention to it. After another fifteen minutes I was sure it was land and it certainly looked good. It was apparent we were making better speed on our return than going out.

We were about a hundred miles from land when it was first sighted as it took us about an hour to reach the coast of Spitzbergen. The remarkable thing was that the oil pressure was still up on the starboard motor, although half of

the oil had leaked away. (Later examination on our return showed the leak was due to a rivet coming loose half way down the tank.) We neared the coast of Spitzbergen within one mile of the point toward which Commander Byrd had set the course—a tribute to his skill as a navigator.

Now we had only one hour more to reach King's Bay. I was glad of that as I had been awfully sleepy for the past two hours. I spiraled down for a landing and came over the field to land. As there were too many people where I wanted to land, I had to make another circle of the field. This time there was a place clear and we settled down safely on the snow and taxied up to the place we left sixteen hours before. Our mission was accomplished, and at last I could get some sleep!

COLUMBUS OF THE AIR

BY AUGUSTUS POST

I

ONE night in May, 1927, a tall, good-looking American boy stands in line unnoticed before a New York moving picture house, like anyone else; a few hours later he drops from the sky in Paris, and the theatre before which he stood is crowded to the roof to see the world's hero upon the screen. No man since men began to make history has risen so swiftly to world wide fame as this young American, Colonel Charles Augustus Lindbergh. The man, the deed and the hour combined to make this the event most quickly and widely known to the greatest multitude of rejoicing human beings. He had just come from San Diego, California, alone, in twenty-one hours, the fastest air time across the Continent, and a record that would have put him on the front page of the newspapers in quieter times than these. But this was only tuning up for the flight that he was about to make; crossing the Atlantic on a sandwich and a half and a few swallows of water; landing at night, on unknown ground, in a machine with not a spot of oil on it nor a sign of having come from across the globe.

North American Review, by permission.

It seems to be the peculiar attribute of Lindbergh to do the formidable, the fantastic and the incredible, in the simplest and most everyday fashion, and to keep this everyday simplicity through the fire of the most intense and exhausting publicity that has ever been turned upon a single individual.

It was eight years ago, while Lindbergh was still a school-boy, that Alcock and Brown made the first air crossing of the Atlantic, linking America with England. This fired Raymond Orteig, of New York City, a passionately patriotic Frenchman, with the determination to do something not only to advance aviation but to bring France into these new world-relations. I was at that time secretary of the Aero Club of America, and it was to me that he telephoned to ask my assistance in formulating plans.

It was clear that the best way would be to link Paris with New York by air. This would require a machine to do double what had ever been done before, new instruments, and scientific navigation in addition to piloting. Naturally Mr. Orteig thought the French would be the first to do it, and so did I; he drew up a deed of gift for twenty-five thousand dollars, and I drew up the rules to win this prize that was a challenge to aviation. Five years passed, however, without a start from either side. The general public did not take it seriously—indeed, up to the very day of Lindbergh's starting, Mr. Orteig was berated in letters to the press, for instigating men to go to their deaths for a deed not only impractical but impossible of accomplishment.

Mr. Orteig, however, extended the time, when an entry came

from the foremost French flyer, Rene Fonck, and an attempt was made. In the following year, 1927, several entries were made from this side, and from France two of the most intrepid flyers of the world, Nungesser and Coli, flew out into the unknown and disappeared. Finally, on May 20, in the mist before morning, Lindbergh rose alone from Roosevelt Field, Mineola, Long Island; was sighted along our coast to the tip of Newfoundland; surprised a fisherman in Dingle Bay by asking from the clouds, "Is this the road to Ireland?" and before the day ended, was in Paris.

The keynote then struck was soon to swell into a world symphony of homage; as he passed from France, to Belgium, to England, kings and commoners joined the acclaim and expressed, each in his own way, the long-waiting joy of humanity at the coming of the first citizen of the world, the first human being truly entitled to give his address as "The Earth," the first Ambassador-at-Large to Creation. Brought home in an American warship, he received the official welcome of his Nation at the hands of the President at Washington, was greeted in New York with a demonstration to which that of Armistice Day alone might be compared, and set sail for home in the plane that he had always recognized as part of himself and partaker of his glory.

The reader of this survey of events, reviewing the great day of Le Bourget from the perspective of even a comparatively brief interval, may be permitted to ask, why all the excitement? Just what is the significance of Charles Lindbergh's achievement, that a world no longer looking on the aeroplane as a

marvel, a world that had already acclaimed the crossing of the Atlantic, the circumnavigation of the globe by air, and the traversing of the North Pole by aeroplane and dirigible, should thrill to this exploit as if life were in some way beginning over again? The answer is that the world is right. Aviation is beginning over again. An epoch in air history was closed by the flight of Lindbergh, and with it an epoch begins.

II

Before the hero of the New York to Paris flight had regained New York on the *Memphis*, another American youth had crossed the Atlantic, this time with a passenger; Clarence Chamberlin with Charles Levine. Steering for Berlin, their gasoline supply had lasted to within a comparatively few miles of their destination, when they were forced down. Chamberlin is another type of American airman in time of peace; he was a "gypsy flyer," the picturesque phrase for a picaresque way of life. The gypsy flyer owns his plane and picks up a living by it however and wherever he can; taking up passengers, buying and selling second-hand machines, taking photographs, and especially stunt-flying at fairs or other open air assemblies. The gypsy flyer has been quite naturally looked down upon by the profession as a sort of aerial acrobat and camp follower, but he furnishes some of the most interesting and significant types of young Americans. The country is, if not full of them, at least well sprinkled with bronzed and competent youths, who may drop from the clouds almost anywhere over the countryside and earn a living by their skill, their courage and their often brilliant resourcefulness.

III

While all this was going on, a scientific expedition, headed by Commander Richard E. Byrd, was waiting suitable weather conditions for an Atlantic flight in the giant monoplane *America*. The crew consisted of Bert Acosta, chief pilot; Lieutenant George O. Noville, radio operator; and Bernt Balchen, reserve pilot. They were not competing for the Orteig Prize, but intended to chart the weather at various altitudes and generally to accumulate scientific data in regard to storms and air currents that would be of value to aircraft plying between America and Europe. Commander Byrd is yet another type of American airman; engineer, naval officer, scientist and explorer, intrepid and devoted. His flights over the Pole and Arctic Regions were made in the interests of exploration, and he is at this writing arranging an expedition to the South Pole. He not only sustains the tradition of the American navy, but represents a family that has been prominent in the councils of the American Nation since the time of Washington.

After waiting, like a good sportsman, for the return of Lindbergh to this country, the *America* took off from the very field from which the other two flights started, kept in touch with shore stations all the way by wireless,—which neither of the other planes did,—but was exceptionally unfortunate in running into dense fog which obscured the ocean for the greater part of the course. When the voyagers reached the coast of France the weather was so thick they were unable to determine their position, and their compass went out of commission for

some unaccountable reason; but in spite of these disheartening difficulties they were able to return to the seacoast, and by the best of airmanship made a fortunate landing at Ver-sur-Mer, in the ocean, coming to shore in their collapsible life-raft.

IV

Brief as the time has been since 1903 when the Wright Brothers rose from the sand dunes of Kitty Hawk and opened the era of aviation, it is already divided into clearly defined periods, with each of which everything may be said to have started all over again. A man still in middle age might have lived through them all; it has been my good fortune to be so placed that I could watch all these developments at close hand. The first division was the period of the Inventors and Builders, such as the Wrights and Curtiss in America, the Voisin Brothers and Bleriot in France; it would be hard to separate builders from inventors, for though the arch-inventors approached the subject by way of laboratory experiments in aerodynamics, and others of their type sought results by elaborate calculation, there were yet others who made valuable contributions to the changing machine by empirical methods, approaching the subject by trying one thing and then another, working "by guess and by gosh," as the farmer built his bridge, and acting as developers in the building process.

Immediately after this came the era of the Demonstrators, the age of "aerial jockeys." At first these were the inventors and builders themselves—Wilbur Wright at Le Mans, France; Orville Wright at Fort Meyer, and Glenn Curtiss elsewhere

in the United States. But soon this duty of demonstration fell to a generation of pupils, who did not add a nut or a bolt to the construction of the machine, who flew what was given them, but who by their intrepid use of what they had, constantly set the constructors new tasks, and constantly required of them new machines that would respond to their abilities and fulfill their demands.

It was this generation that by concentrating on flying proved possibilities undreamed of by the public, and only remotely hoped for by the builder. Pegaud's feat in looping-the-loop was reviled by the unthinking as foolhardiness, serving no good purpose; a reproach that has never been withheld from any stage of development of air flight, and from which even Lindbergh himself has not been free. But by Pegaud the aeroplane builder was challenged to provide for all future flyers a machine that would withstand the strain of this new manœuvre, to the general improvement of the plane and to the vast enlargement of the possibilities of flight, especially in warfare. During this period these expert demonstrators developed the plane by races and contests in reliability and speed, and carried it to undreamed of altitudes. They were enlarging the pattern: already by the close of this era, the Atlantic Flight was on the horizon as the greatest possibility of all in the way of demonstration.

V

But this period was to come to a violent end. The World War intervened. Only to compare the little, light machine that went into the war with the deadly efficiency of the engines that

emerged from it, is to see for one's self that this period brought about developments in aviation comparable only to those in surgery and in chemistry. The vital necessity that made surgeons and chemists take chances that a century of peace would not justify, sent men into the clouds to perform the impossible and make it the commonplace of a flyer's day. This period added armament to the plane and made the gun its *raison d'être*, with flying only a means to this end instead of an occupation for all the powers and energies of hand and brain, as heretofore. It not only developed a type of flyer who could run his machine almost automatically, reserving his darting intelligence for the exigencies of conflict, but it laid upon the builder the necessity of providing him with a plane whose mechanism would respond at once to the most sensitive control. When the war stopped, the Ace had been evolved, a creature whose personality extended to the tips of its wings and in whom mind and motor were one.

Opportunity for the Ace stopped with the war, and with the coming of the fourth period, Commercial Aviation, the machine began to take first place in the public mind—the machine and the organization that made its operation possible on a large scale. Air lines opened in every direction in Europe, and became in a short time a valued method of transportation, not only in respect to speed, but for the even more important qualification of safety. The Channel as a barrier had crumbled under Bleriot and disappeared during the war; it was now to be crossed daily by steady airgoing craft used by tourists no more freely than by staid business men desiring conservative and speedy methods of transportation for themselves and for

fragile merchandise. From every airport of Europe lines crossed and recrossed the map. The globe was circled, Australia linked to the mother-country, the Sahara opened and Darkest Africa illuminated; the Atlantic, North and South, was crossed no less than fifteen times by airship and aeroplane; the islands of the Pacific, Hawaii and the Aleutian Islands were joined to the mainland, the flights depending in each instance not only upon the skill of the pilots in flying and navigating, but upon long preparation, organization and team work of their supporters, in some instances of supporting Governments. But although our Government took some part in this procession, the peak of our activity in this period was the air mail, a fine example of organized support of individual bravery and skill.

VI

The actual achievement of Lindbergh is easily set down. In a monoplane named for the city of his financial backers, *The Spirit of St. Louis*, built for him in sixty days, he flew on May 20-21, 1927, 3,610 flying miles, without stop or deviation from a determined course, in thirty-three hours and twenty-nine minutes. His only new instrument of importance was the earth-inductor compass; this he constantly watched, and in order to fly, as he flew, on the arc of a great circle, it had to adjust about every hundred miles. He had continually to judge the side-drift of his machine and allow for it, and also to use his judgment in manœuvring around fog and storm centres. The distance he covered constituted the world's record for non-stop flight, at the time, but this was never emphasized in the popu-

lar mind, and I doubt if one man in a thousand who cheered Lindbergh could have told offhand the number of miles that he had flown in those memorable hours above the ocean.

There are some flights that make records and some that make history: this was a history-making flight. As with all the other periods of flying history, everything is beginning over again with it. Attention is again directed, not only to the machine, but to the man, as in the first days, when aviation was a matter of great individuals. Old and young share in the thrill, for youth acclaims the young hero and to those who lived through the pioneer days, the days of pioneering begin anew. In 1926 Commander Byrd's magnificent feat in crossing the North Pole roused the admiration of the world, but once done it was, so far as the public mind was concerned, done with, while Lindbergh's flight, almost immediately followed by Chamberlin's and then by Byrd's, seems even to the unimaginative the opening of a new era of transportation. As important as its being done was the fact that it was done on time, and again, it was the aspect of ambassadorship that loomed large in the public imagination. America is a long way off from Europe, and, with the best will in the world, professional diplomacy does not always tend to diminish the distance. Radio—whose development has progressed step by step with aviation, as the telegraph accompanied the railroad and the telephone the automobile—was doing much to bring the two hemispheres together in thought, but it needed the actual crossing at a single step of this level-headed boy, bringing a greeting no more official than his first words "I'm Charles Lindbergh," but with

a smile that carried with it those assurances of good will that words are more apt to obscure than to explain. There is no doubt that Europe took his coming in this spirit, and Lindbergh was fulfilling a sacred trust to humanity when in his brief speech to the multitudes at Washington and to the thirty millions of radio listeners, he spoke only of the affection for America that he had seen and felt everywhere displayed, in France, in Belgium and in England, and of his sense of obligation to bring back with him the impression of this frame of mind, undimmed by time, and transmit it to his countrymen.

VII

People appreciate what comes within their experience. Though the public thought the flight was great, it was even more impressed by the flawless tact with which Lindbergh met the kings of the Old World and the crowds of the New, and the unerring judgment that steered him past the two storm centers of sentimentality and commercialism. He conveyed far more by his actions than he did by his words, well chosen as they invariably were; he brought new power and vitality to diplomacy by the addition of the dramatic element.

His actions the public could see, but what it could only faintly envisage was, after all, the flight itself. This, strictly speaking, not more than a dozen men can really appreciate; these are the aviators who have had at least a similar experience; who have made, or partly made, a transoceanic flight. They know the fierceness of the forces that block the road through the unknown, the icy mist that may reduce the lifting

power of the wings and in a moment change success to failure, life to death; the swift springing storms or blinding fog that may, as they did for Byrd, blot out land and sea for nineteen hours together, and the immeasurable waste of waters whose very thought pulls down the mind, the waters that hold somewhere the secret of Nungesser and Coli. But aviators in general, given even a slight amount of imagination, can appreciate all this indirectly, and it is from them that the praise most valued by Lindbergh has come. It is they also who can value the exploit of Byrd as it should be valued. With the public at large the disposition has been to regard it as a flight that failed only in its avowed objective; though it was beset with incidents of dramatic grandeur. The superhuman skill and the highest science of aerial navigation on the part of Commander Byrd, and the cool bravery and heroic courage of each member of the crew, brought them through imminent dangers in safety to a well earned ovation from the nations of the world as well as of all their fellow citizens of America. Chamberlin, heading for Berlin, found himself in a cucumber-patch in Kottbus; the fact that this was some miles further than Lindbergh had flown did not count with the crowd in comparison with the fact that it was some miles short of the spot he had expected to reach—though he had carefully refrained from making official announcement of this expectation. Byrd, in the *America*, carried three times the weight, chanced three times the motor difficulties, and, with four times the human risk, completed a tremendous scientific experiment, and revealed the possibilities of radio communication almost as remarkable as those of the aeroplane,

and demonstrated, against almost inconceivable dangers and difficulties, that it was by no mere lucky fluke that the others had made the flight, and that the crossing could be made in almost any weather.

The trans-Pacific flight of Maitland and Hegenberger, which took place with brilliant precision at almost the same time as Byrd's, was but another proof to the public of the marvelous state of accuracy to which the navigation of aircraft had reached; such small objects as the Hawaiian Islands, after a flight of twenty-five hours and fifty minutes, could be hit "plumb on the nose," although they were a distance of twenty-four hundred miles away over water. But long distance flights are becoming of everyday occurrence and the public no longer complains that human life is being risked for only a brief moment of glory. The mortality rate has always been lower for aviation than people generally believed, for the emphasis has been not upon the man that flies but the man that falls; now the expectation is that the pilot will win through, just as the traveller on the railroad train believes that he will reach Chicago on time. If there is a train wreck the papers do not at once complain that the steam engine is an affront to Providence.

Lindbergh's perfect flight revealed the highest and noblest characteristics of man: daring, skill, calculation and genius. It brought into the limelight of public knowledge the vast height of attainment and the tremendous possibilities even now at our command in the aeroplane of today; and as a flash of lightning illumines the landscape for a moment so that we see the moun-

tain peaks upon the horizon, so this brilliant deed revealed to the imagination of man a clear vision of the future. He had faith not only in his motor but, what is still more important, in himself, and he was upheld by the wishes, the hopes and the prayers of the whole Nation.

VIII

Today not only the airmen but the earthmen are planning and prophesying. In 1914 I wrote an article called *Columbus of the Air*, and I said:

"A man is now living who will be the first human being to cross the Atlantic ocean through the air. He will cross while he is still a young man. All at once, Europe will move two days nearer; instead of five days away, it will be distant only thirty hours. . . . It would seem out of keeping with the general economy of weight, when even the parts are not duplicated, that the pilot should be carried in duplicate. . . . As for keeping awake and alert for the whole time of the flight, every aeronaut knows that this is possible. I myself have kept alert for longer periods than this several times in international balloon races. Whoever crosses the ocean through the air for the first time will be too busy to be lonesome.

. . . Imagine then, the welcome that awaits the Columbus of the air! The cable warns of his departure, before him flies the wireless announcing his progress. Ship after ship, waiting the great moment, catches glimpses of the black dot in the sky; ocean steamers bearing each a cityful of human beings, train thousands of glasses on the tiny winged thing, advance herald

of the aerial age. The ocean comes to life with gazing humanity; above all he rides, solitary, intent. There will have been no time to decorate for his coming; flags will run up hurriedly, roofs in an instant turn black with people, wharves and streets white with upturned faces, while over the heads of the multitude he rides in, to such a shout as the ear of man has never heard. No explorer ever knew such a welcome, no conqueror, as awaits the 'Columbus of the Air.' "

To say that within less than a decade America will be covered with commercial air-lines is only to remind the public that America is now far behind Europe, where time-tables for air routes are at this time as much a part of a business man's equipment as those for land or sea. Landing devices must be improved; this is most evident in the case of airships. Indeed the main reason for the lagging behind of the dirigible is that it must be pulled down to earth by a swarm of men. Imagine the *Leviathan* being warped into her dock by an army of men each pulling on a rope, and you have something like the present anachronism in the working of the dirigible. That this will be overcome there can be no doubt, nor that the landing devices of aeroplanes will be made safer than they are at present. The parachute as an emergency measure with the aeroplane is of comparatively recent date, and in its present improved form provides something like that "sky-hook" the old-timers used to declare every aviator needed. Platforms over city blocks and piers will make every city a port of the air and bring to pass the famous predictions of Kipling's *With the Night Mail*. There will be "floating islands" in the ocean and moored ships for

weather reports with *ballons sondes* and kites for high altitude data; mail and passengers will be flown to shore from Atlantic liners, cutting two days off the passage. New and better instruments will come, a capacity indicator to show how high you are above the surface of the ground will make crossing mountains less perilous, and an instrument will measure distance traveled over the earth's surface, and an automatic pilot keep a predetermined course as set by an earth-inductor compass, as is done now on ocean liners by what is known to seamen as "Metal Mike." We will have devices to dissipate and to guide through fog, the greatest enemy of all craft, especially to assist pilots to land; neon lights and wireless beacons and powerful radio direction stations to transmit meteorological information and give bearings must be generally established with observation stations in the Polar Regions, on the ice-cap of Greenland and in the Antarctic. In the course of these investigations and discoveries, great flights must soon be made. No spot on the earth will be unseen by man. The Pacific will be crossed in a single flight, the world circumnavigated in fifteen days. Heights of 50,000 feet will be reached, and it may be possible to utilize the vast possibilities of speed at very great altitudes. We may see "superterranean" machines with apparatus for supplying passengers with air under pressure mixed with oxygen; Breguet built such a machine in France; and on account of the reduced resistance of the air speeds of five hundred miles an hour might be attained, according to some authorities. Experiments are now in progress in the use of the reactionary principle in propulsion, doing away with the

propeller and motor as used in the present plane and substituting the exhaust of liquid air through nozzles. Wireless transmission of power is still distant, but not below the horizon. Machines have been re-fueled in the air, enabling them to make continuous journeys of indefinite duration. By the time the earthbound reader has reached this point in this conservative forecast, his mind may be preparing to let go, and it is time to round off this survey of reasonable possibilities of the future of air transport.

"THE KID"

BY VICTOR A. SMITH

GAWD-A-MITY, don't look! That fool Kid is at it again." The C. O. ducked and turned away. I didn't. I knew the Kid. He had taught me to fly and I was used to his hair-raising stunts. But he'd only been with us about ten days and the C. O. and everybody else still threw fits every time he went up. They were all afraid—that is, all but the Kid. "Fear," as Alex Smart, the field fool put it, "wasn't in the Kid's Webster. He didn't Noah the word."

The Kid could do more things with a plane than any man I ever saw and I'd seen 'em all—good and bad. His reputation, like his nickname, had preceded his coming to us, but there was a lot of head-wagging and many doubtful looks the day a dapper little fellow about five feet three inches high, weighing just over a hundred pounds and looking about seventeen years of age, reported for duty as the much touted new instructor.

"Your name," said the C. O.

"The Kid," answered the new instructor.

"I mean your real name. Haven't you one?"

From the Aero Digest N. Y. By permission.

"Sure."

And the Kid did, this way: T. H. E. Kidd.

"Who'll we notify in the case of accident?"

"Nobody," said the Kid, "there ain't gonner be no accident. Me and the American Eagle is buddies."

The C. O. let the Kid get away with it.

About that American eagle the Kid told the truth. An old silver dollar was his luck piece and I remember how, at another field, he had lost it one night in a crap game. That was three days before payday. In those three days he never touched a plane, but the minute he got his money he started out to find his dollar. He paid the robber that had it ten dollars to get it back. Then he went up. Like a blinking idiot, I went with him. On that flight, the Kid invented sky-writing.

By the time he had been with us a week, the Kid was a popular favorite. Everybody, from the C. O. down, loved him. That is, everybody but Bill Brawler. Bill was a great rough-neck of a husky, so, naturally, with his initials, he became the original Big Boy, and he had been, until the Kid's arrival, the flying hero of our outfit.

Two days after the Kid reached us, he and Big Boy happened to be up at the same time. The B. B. decided he'd show the Kid up and he started a lot of fancy stuff. The Kid watched him for a little while, then he got busy. He looped and nose-dived and did falling leaves all around the Big Boy. He flew so close to him that the Big Boy got nervous and started to get away, but the Kid was right on his tail. Then, gradually, he got above him and judging his dive to within ten feet of the

Big Boy's plane, he pulled off the prettiest noser anybody ever saw. It completely got the B. B.'s nerve and he started down with the Kid just above him all the time, circling around like an eagle after his prey.

The Big Boy came to earth, literally run out of the air. But the Kid stayed up a few minutes longer. By the time he came down, the Big Boy had been pretty well kidded and he was sore. After that he was always making dirty digs at and about the Kid, who stood it like the sport he was until one night when six or eight of us were having a quiet little party. Present were a couple of quarts of white lightning, two or three sets of nice dice and very little money. The Big Boy wasn't expected, but he came in. He'd had a few and when he saw the Kid a nasty look came into his eyes.

"Hello, you little son-of—"

"Wait a minute, Big Boy," drawled the Kid. "Don't call me that. Us southern fellows only use that particular cuss word in so-called funny stories, or when we're hankering for a nice big fight."

"Fight, hell," snarled the Big Boy. "Why, Kid, I can break you with two fingers of my left hand."

"Fair enough," said the Kid very quietly, "but I've warned you."

Nothing else was said, the tension passed and the B. B. edged into the circle around the table, but on the opposite side from the Kid. Presently the dice got around to him. Looking at the Kid as if to nag him on, he said—

"I'll shoot five bucks."

Nobody said a word. Our speed that night was about a quarter.

"What's 'a matter," snarled the Big Boy, "are you pikers broke?" Again he looked at the Kid, who then dug down into his pocket and pulled out four one-dollar bills. There was a dollar on the table in front of me. As the Kid reached for it, I nodded.

"Ain't there any he-sports in this crowd of cheap skates," said the Big Boy, again right at the Kid. "I'm shooting five bucks."

"You're faded," said the Kid as he threw down his five ones.

"Y'don't say," came back the Big Boy. "Well, I don't shoot craps with no little southern son-of-"

He didn't get any further. Like a flash the Kid was over the table and at him. His body landed square in the Big Boy's arms and his fist landed square in the Big Boy's mouth. The impact from the Kid's jump threw both the fighters to the floor. When we pulled the Kid off two minutes later, the Big Boy had two black eyes and three front teeth were missing. Then the Kid said—"I'm sorry, Big Boy, but I told you we didn't use that word down south unless we were huntin' trouble." Then he bathed the B. B.'s eyes, saw him to his quarters and said "good-night" just as though nothing had happened. The aftermath was, and this is to the Big Boy's credit, he became the Kid's greatest admirer. Of course, the Kid harbored no grudge. He met the Big Boy half-way and taught him a lot of his stunts.

It was on one of their flights together that the Kid walked

out on the wing of his plane to wig-wag "hello" to the fellows below. Every man of 'em turned away.

"Is the Kid trying to commit suicide?" said some one.

When they got down the C. O. gave the Kid particular, red-hot hell. He just grinned and said—"What's all the row about? I'm here, ain't I?"

"Yes, but you won't be long if you keep up that foolishness."

But the Kid did keep it up and never did he get a scratch until one day he asked leave to let him spend the week-end at home. The C. O., thinking he was going by train, said 'all right.' The Kid's home was just 200 miles from the field. At ten in the morning he telephoned his folks that he'd drop in on 'em that day at one o'clock for dinner. He did. His father fished him out of a live oak tree, in his own back yard, at twelve forty-five. The Kid had fallen two thousand feet and with the exception of a ruined uniform and a few scratches, he wasn't hurt. His plane was not even badly damaged. He told me later that it was just like landing in a feather bed. "Always," he said, "pick out a nice, big live oak tree to fall in."

The Kid came back to the field on the train. When the C. O. heard his report, he immediately ordered him to Texas, from which place, it so happened, he had that day received a request for the loan of an instructor.

"How'll I travel?" asked the Kid.

"On the train," answered the C. O.

"All right," said the Kid, "I'll leave tonight."

"Good," said the C. O. "Now I know you'll get there alive, anyway."

"You're damn'd tootin'," said the Kid as he walked away.

"C. O.," I asked, "Why do you let the Kid talk to you like that?"

"Well," he replied, "I happen to know all about that boy and his family. I know, too, that the Kid has refused three commissions, because, he said, he didn't want to be weighted down with shoulder straps and could do better instructing as a private with privates; and finally, Captain, because I'm so fond of him. I honestly hate to see him go, but if he stays much longer I'll have a nervous breakdown. That's really why I'm sending him away. I just can't stand the strain of his stunts any longer."

The Kid left us that night. Two days later the C. O. received the following telegram, collect—

"Saved the Government five hundred dollar repair bill and railroad fare by fixing up plane I damaged at home last week and flying to Texas in it. Told you I'd get here safe."

The C. O. exclaimed, "he ought to be court-martialed!" But, as far as I know, he never was.

DOWN TO THE EARTH IN 'CHUTES

BY LIEUTENANT G. A. SHOEMAKER

*Former Chief Instructor in Parachute Jumping,
Army Air Corps*

PARACHUTES have saved the lives of nearly one hundred American airmen in the past two years. Their adoption as a standard part of pilots' equipment has saved for our air services more pilots than would normally graduate from one of our advanced flying schools in a year. Yet, it was only six years ago that jumping was regarded as high adventure in the air service. In the spring of 1920 there were only six of us who had ever taken the leap from an Army airplane.

The present perfection of parachute design was only attained after making many radical alterations of the original training type in which we made the first jumps. Each alteration was followed by weight tests and then it was my job to make the first live jump with the remodeled chute. Some of these tests were productive of real thrills.

The seat pack, which is now the standard service chute, required many months of experimental jumping and alterations

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before we reduced its landing speed to a safe figure. We tested various diameters ranging from 18 to 24 feet. On the first jump ever made with a seat pack I attained a rate of descent of 40 feet per second. As the normal rate is only 17 feet per second the chute was unsafe for service. We had on that day taken the precaution of putting one plane in the air with orders to circle the field at a constant altitude of 1000 feet. We ascended to 3000 feet from where I jumped. In checking my elapsed time from leaving my plane and arriving abreast of the one at the 1000-foot level, I found the distance had been covered in 50 seconds. To land at the speed at which I was traveling would not have been healthful. A reserve chute, one of the old training type, was on my chest for just such an emergency and I lost no time in opening it.

It was later discovered that by cutting the silk panels of the chute on the bias more resistance was offered to the air in descent and as a result the speed decreased. This, together with a new type of vent, gave us a chute that landed at 17 feet per second and was small enough to make a compact pack. Such a chute is today the most efficient airplane life preserver in the world.

Many student classes were trained by us at the Air Service Mechanics' School. One of my first pupils was the present Assistant Chief of Air Service, Brigadier General James Fechet. In August, 1920, he was Lieut. Colonel and Air Officer of the 8th Corps Area. Colonel Fechet displayed a keen interest in our parachute work at Kelly Field and was a frequent visitor. One day he rode the rear cockpit while Lieut. Eugene Eubanks

and I were making the first double "lift-off" from the upper wings of a DH. The next day Colonel Fechet came to the parachute school and informed us that he wished to make a lift-off from the upper wing that afternoon. After witnessing the packing of his chute he was ready for the jump.

Just before taking his place on the wing the Colonel was informed of the signals to be used between us after taking the air. After we had reached an altitude of about 3500 feet a slight mishap occurred. His goggles flew to the rear of his helmet and the rush of air over the wing was blinding him. Hanging to a supporting rope with one hand, he at last recovered the straying goggles with the other and we were again ready for the jump. I signaled him to rise to his feet. A half-inch rope was attached to the leading edge of the wing for use as a support when in this position. It was only two feet long and the day before I had discovered that it had to be held as loosely as possible in order to prevent burning the palm when the chute lifted one off the wing. As the Colonel stood up I was astounded to see that he had taken a half hitch with the rope about his right wrist. He was awaiting the signal to pull his rip cord and I was afraid to move a hand lest he interpret it as a signal to go. Should he pull the cord his arm might be torn off and worse might happen.

Kneeling down on my small platform I began to attract his attention with constant negative shakes of my head. At the same time I looked back at the pilot and signaled him to make another circle over the field. Then began a series of gestures for the Colonel's benefit. Using my right hand and my own

guide rope I at last attracted his attention to the position of his own rope and was rewarded by seeing him take the proper grip and look over to me for approval. All this time he had been on his feet on the wing and I had been in various poses. We were both worn out. As soon as we reached a position over the field where it would be safe to lift off the signal was given and Colonel Fechet took the air. It was the first and the only time I have ever seen a field officer tumbled head over heels into space. Leaping immediately after the Colonel I drifted over toward him and both saw and heard him land with a resounding thud. As he arose to his feet his first words were "wait till my wife hears about this." The Colonel had a badly burned palm but otherwise was unhurt. He also was game for another jump.

Lieut. Jimmie Doolittle, winner of last year's Schneider Cup competition at Baltimore, was another of my pupils who had a most interesting introduction to the parachute. The platforms which had been placed on the upper wing surfaces to protect the fabric against our weight were of very light wood construction. To reduce the air pressure beneath them while in flight and so keep them from tearing loose from the wing spars to which they were screwed, we left openings almost a half-inch wide between the boards. The entire platform was only two feet square. Doolittle and I took off for his first jump laying on two such platforms. After we had attained our altitude we were flying over South San Antonio, headed for the field. I signaled him to rise to his feet as we would be ready to lift off in a few seconds. After this signal I again looked ahead toward

the field. As we approached the spot over which I wanted him to pull his rip cord I turned to his side of the plane to give the signal and was greatly surprised to find him gone.

Looking back at the pilot I saw him waving his hand to the rear. There, floating slowly to earth, was Jimmie. He was headed for the outskirts of the village of South San Antonio. I jumped at once and upon landing in the field ordered the ambulance which met me to drive toward the spot where Doolittle would probably land. The plane had turned about and was now circling over this area. About twenty minutes later we found him suspended from the branches of a small oak tree, his chute draped over the topmost branches and his feet just out of reach of the ground. No one had seen him come down and his harness had held him a close prisoner.

It developed then that, while we were lying on the wing platform his rip cord ring had dropped through one of the cracks in the platform and as he got the signal to rise and made his first move the cord had been accidentally pulled and the parachute released. By this mishap we discovered that a person could leave the wing while the plane was in normal flying position. Prior to this time we had always banked to the left wing to let the man on the left off and side slipped to unload the one on the right. It had been our opinion that we would strike the tail surfaces unless our ship had been so manœuvered.

Students were at first introduced to the parachute by making a live jump from the step alongside the front cockpit. Two classes were graduated in this manner. Then, as a result of a near fatality, we were forced to cast about for a safer method

of getting the student off on his first leap. The lift-off from the upper wing was the solution.

Our engineers figured that the wing of a DH would support the weight of a man's body at the take-off without undue danger. For the first jump of this type I had no platform to protect the fabric. A rope was stretched along the leading edge of the upper wing and to this rope another was tied in a place directly in front of where I was to take my position. This was to give me added support after rising to my feet as about to leave the plane. Lieut. Harry Weddington piloted the ship.

San Antonio newspapers had been none too optimistic as to the outcome of the stunt and as a result a large crowd were assembled at Kelly field when we were ready to take off for this first lift-off. The only bad moment we had was as the plane was reaching flying speed and we were cutting along the top of the grass. Weddington could not tell how much extra aileron it would take to overcome my added weight and as a result over-controlled and almost rolled me off the wing. This was overcome in an instant and for the rest of the trip we maintained an even keel. It was most pleasant riding on the wing away from the slipstream.

Another plane was flying only fifty feet away with a newsreel cameraman aboard to get the pictures. As we reached 3000 feet I arose to my feet and Weddington put the plane into a side-slip so as to assure my clearing the tail surfaces with my chute and body. Giving the rip cord a jerk I found my chute lifting me off and the next instant I was on the way down to the field. After this experiment we adopted the lift-off method for all our

students. We found that with two men on the upper wings the plane balanced perfectly and was easy to handle. The chance that a student would "freeze" onto his rip cord and neglect to open the chute was eliminated. So it was through another mishap that we found the safest way to put the novice into the air for his first leap. Just prior to my experiment a student had "frozen" after leaving the step and after falling 500 feet his chute had opened as a result of his left hand having the rip cord in a death grip and as his body began to spin in the fall, the centrifugal force had flung his arm away from his trunk and torn the pack open.

My most thrilling experience while in parachute work came one afternoon at Chanute Field at Rantoul, Illinois. Lieut. Hamilton, former holder of the world's parachute altitude record, was riding the other wing with me and we were merely making a practice jump. He was wearing standard training chutes and I was equipped with the newly perfected seat pack. Hamilton got away in good shape and as I reached for my rip cord to open my own chute we hit a bump in the air which threw my wing up several feet and pitched me off forward toward the propeller.

In that short instant I pictured in my mind the results to the plane, pilot and myself should my body hit that whirring prop. I also saw the result that would follow should I open my chute and become entangled in the tail surfaces. I had been thrown well toward the engine. Having made about two hundred jumps with Weddington always piloting the plane I figured that he would sense the danger and do the only thing left to do—

give the ship hard right rudder and drive the tail away over to the left. This would allow me to open my chute from where I was falling without so much danger of striking the tail. All these thoughts flashed through my mind in a fraction of a second. Confidence in my pilot enabled me to take the chance of opening the chute which I did. The chute cleared the fuselage and tail surfaces by inches and my body at the end of the shroud lines flew by Weddington so closely that I could have touched him. As I cleared the horizontal stabilizer my elbow struck it a glancing blow. We all came out of this tight situation with no one on the ground realizing at any time the predicament we were in. Had I been equipped with the larger training chutes such as Hamilton wore on the other wing this might not have been written.

Almost every time we made a parachute jump we learned something new which we could pass on to new students and which added to their safety. When an emergency arises, to have had the experience of a jump under ideal conditions behind one is of inestimable value and very few of our pilots are without this training.

THE WILKINS ARCTIC EXPEDITIONS

BY A. M. SMITH

*Detroit News and North American Newspaper Alliance correspondent,
Detroit News—Wilkins Arctic Expedition, 1927*

THE Eskimos of Barrow would say that Captain George Hubert Wilkins "knows his muktuk." Since 1914, they have called him "Anakluto," which means "strong-wise-man."

How many white folks have called Wilkins a fool, because the exploratory efforts of the Wilkins expeditions of 1926 and '27 failed of their objective, that is, a series of flights over various areas of the Arctic Ocean, with landings and the gathering of scientific data?

No one has made the count of the smirkers and critics. They at least served to amuse Wilkins, for he is too well acquainted with the fickleness of the thrill-hunting public to be disturbed by the carping criticism of the ignorant herd.

More than once I have said to the man who guffawed at the Wilkins expeditions of 1926 and '27: "Mr. Man! Go on up to the Arctic. Get into the comforting temperature of 40 below zero. Go out over the most desolate, threatening—and threat-fulfilling—place on the face of this earth. Go in an airplane.

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Get an Arctic blizzard to help you go and to prevent you from returning. When you get there, feel of your pulse—if you can still feel. And when you get back—if you ever do—tell us what kinds of fool you were.”

“Sure!” replies Mr. Man. “Anyone is a fool to go there like that.”

Today, the highest award of the American Geographic Society, the Samuel Finley Breese Morse gold medal; a flood of congratulatory messages from all parts of the civilized world, some from crowned heads, and many from friends who never misunderstood Wilkins’ purpose and mission in the aerial exploration of the Arctic, and know him for what he is, “Anak-luto,” are the answer to “Fool” from the ranks of the ignorant, fireside smugs.

Sharing in the honor and congratulation of the world, is Wilkins’ gentleman friend, Carl Ben Eielson, more gentleman than a college and two university courses could make him, though he had that training. Eielson, like Wilkins, was born with the soul of a gentleman, with all the finesse of modesty, sense of proportion, tenacity of purpose, quiet and efficient performance which born gentlemanliness implies.

Neither Wilkins nor Eielson were ever interested in aviation stunts. The most skillful piloting under the most difficult conditions in the history of aviation has been Eielson’s contribution to the new science of the air.

In all the plans and work of the three Wilkins Arctic Expeditions, both Wilkins and Eielson were interested solely in gathering new and useful knowledge about a large and important

unexplored area of this earth. How important such knowledge would be, if gained, they fully understand, as all scientifically-minded people do. They knew they had the sympathetic and understanding backing of the small minority of people—the scientists—and with that they were content to go ahead, merely amused by the critics and the hoi poloi who said: "Fools."

I have digressed at the outset in this outline of the work of the Wilkins Arctic Expeditions because, after all, the human element is at the heart of anything interesting to thoughtful people. And because, with all the real friends of the two "heroes of the hour," I take vast comfort in looking over the former critics who today are "eating up" the news about these two men, and I smack my lips as I wink one eye at them. There is a deal of comfort in "I told you so."

However, the critical attitude of the world that acclaims the man who goes through a hero, and condemns the same man as a fool if anything stops him from going through, had a certain unhappy effect on the plans of Wilkins in the early months of preparation for the expedition of this year. It left him out in the cold, so to speak.

It threw him back on his personal resources in financing the expedition, and he had invested virtually all of his personal fortune in the expeditions of 1926 and '27. The excitement and romance of those two expeditions had passed. Neither of them had gained the results hoped for. There were some friends who doubtless would have chipped in to help finance this last flight if Wilkins had undertaken the role of salesman. Personal pride and dignity, and the dogged independence which

is always the other side of the shield of Courage, doubtless stopped him from making any appeal for financial aid.

The three Wilkins Arctic Expeditions of 1926, '27, and '28 covered more than 17,400 miles in flights above the Arctic Circle, with the loss of only one plane (Stinson biplane) in exploratory flights; the destruction of one Fokker wing in a test flight at Fairbanks, Alaska; the loss of one man, Palmer H. Hutchinson, Detroit News and North American Newspaper Alliance correspondent on the 1926 expedition, who stepped back into a whirling propeller of the tri-motored Fokker on the landing field at Fairbanks; and the loss of one finger, from freezing, by Eielson, chief pilot, on the 1927 expedition.

The total personnel of the three expeditions was 20 men—11 in 1926; 7 in 1927; 2 in 1928.

Major Thomas G. Lamphier, of Selfridge Field, on the 1926 expedition covered approximately 1,000 miles in flights between Fairbanks and Barrow, the Arctic shore base of exploration. Alger Graham, of Detroit, relief pilot of the 1927 expedition, made approximately 5,000 miles in similar flights and in the Arctic shore area. Eielson, pioneer of Alaskan pilots and the most experienced of all Arctic aviators who have tried their wings in those regions, covered approximately 10,000 miles on the three expeditions. Joe Crosson, who has flown all over Alaska in the past five years, made two flights for the expedition of 1927, totalling 1,400 miles.

On all of these flights, except trips by Lamphier, Crosson, and some of Graham's shore flights, Captain Wilkins was navigator with Eielson or Graham, and has to his credit a total of approximately 13,000 miles of Arctic flying.



PHOTO BY TIMES WIDE WORLD

Capt. Sir Hubert Wilkins after Flight over the North Pole

Four different types of planes were used—Fokker, Stinson biplane, Swallow and Lockheed. Two Fokkers, one with Liberty Engine, and one tri-motored with Wright Whirlwinds, were used. Two Stinsons, with Wright Whirlwinds; the Swallow with a Hispano-Suiza motor; and the Lockheed, with Wright Whirlwind.

Landing gears were used in tests and on flights were wheels, landing on dirt, snow and ice; skis, both wood and Severski metal, the latter landing on ground in the last flight of the 1927 expedition from Barrow to Fairbanks; and a combination of skis and wheels was tried out in tests.

The Fokker plane made a total of six round trips over the Endicott Mountains in 1926, from Fairbanks to Barrow, rising, as all planes on this route must, to 9,000 elevation to clear the lowest point, Anaktuvak Pass, and carrying loads up to 6,000 pounds, chiefly gasoline.

The Stinsons were loaded up to 2300 pounds. The Lockheed, in Wilkins' and Eielson's flight from Barrow to Spitzbergen, took off with a load of more than 3,000 pounds, the bulk of this consisting of 370 gallons of gasoline and 12 gallons of oil.

Temperatures ranging from 33 above to 48 below zero, were encountered in the various flights of the expedition, the lowest, 48 when Wilkins and Eielson neared Spitzbergen on their last flight. Except for the inconvenience and delay of warming motors by covering them with tents, with oil stoves underneath, before starting in low temperatures, the cold of the Arctic did not appear at any time to prevent the proper functioning of motors.

The only forced landings, during the three expeditions, were those of March 29, 1927, when Wilkins and Eielson, 500 miles northwest of Barrow, were compelled to come down because a leaky oil pipe fouled one of the magnetos of their Stinson; and their landing that night, after nine o'clock, because of failure of gasoline, after they had fought their way to 100 miles of the coast against a southwest blizzard with wind at 70 miles per hour. Coming down in pitch darkness, unable to see out of the windows of the cabin, they crashed on the ice, breaking the skis, but with no other mishap. They were held in the plane cabin for five days by the blizzard, then took 13 days to walk 80 miles to shore, arriving at Beachy Point, 92 miles down the east shore from Barrow. During their wait of five days in the plane they had drifted 167 miles southeastward.

On that one flight they succeeded in taking a sounding of more than three miles, 500 miles northwest of Barrow, proving the continental shelf in that direction, and the impossibility of land in that area of the Arctic.

The expedition of 1926 was sponsored by the Detroit Aviation Society and the American Geographic Society, and by the people of Detroit. It failed in Arctic exploratory flights because the Endicott mountains proved impassable to dog teams trying to get gasoline through to Barrow.

The expedition of 1927 was sponsored by the Detroit News, the North American Newspaper Alliance, and the American Geographic Society; the Detroit News bearing most of the expense of the expedition.

At the termination of that expedition, the Detroit News gave

to Captain Wilkins the remaining Stinson plane. The Fokker had been left in Fairbanks, during the 1927 expedition, because the propeller would not lift a useful load over the Endicott mountains. This plane, and the fuselage of the other Fokker, whose wing had been crashed the year before, were the property of Captain Wilkins. He sold the Stinson and the Fokker equipment, and put the proceeds into the Lockheed plane of his 1928 expedition.

Wilkins and Eielson were the total personnel of this last expedition. They left Fairbanks in the Lockheed March 20; flew over the Endicott range to Barrow, and on April 15th made their memorable flight to Spitzbergen, landing on a small island in the north of the archipelago, where they were storm bound for five days, finally getting off again and landing safely at Green Harbor, where, as this is written, they were waiting for the Arctic ice to break up sufficiently to allow a boat from Norway to bring them out.

The severity of the weather; the storm area into which they ran on the Spitzbergen side; the impossibility of safe landing on the ice en route; and, more than all else, the rapid and great changes of magnetic fields in the area northeast of Barrow on their route, makes the flight to Spitzbergen epochal in history of aviation.

They crossed the area of the northern hemisphere most difficult of aerial navigation, in a flight of 2,200 miles, terminating in the worst storm Spitzbergen has seen in years in the month of April, and reached their target in a non-stop flight—a remarkable feat of navigation.

The fact that no land was discovered on this flight is a negative scientific result, but of great value to oceanography and to meteorological developments of the future. Captain Wilkins reports that over a distance of 120 miles, an area between Greenland and the Pole was blanketed with fog, making it impossible to determine whether there might be land there. Except for this spot, their route, for nearly 100 miles on either side, was free from land, though this fog, like a drawn curtain, may have shut off extensive land to the north.

Will they go again? If they do the whole world will wish them God-speed, for the world today acknowledges the courage, skill and steadfastness of purpose of Wilkins and Eielson.

THE "BREMEN'S" FLIGHT TO AMERICA

BY JESSIE E. HORSFALL.

THE first westward non-stop flight of an airplane across the North Atlantic nearly ended in disaster before the wheels were three feet off the ground. A runway 4,000 feet long had been constructed at Baldonnell, the military flying field on the outskirts of Dublin. The wall surrounding the military reservation was removed and the runway extended into pasturage lands that lay beyond. The heavily loaded *Bremen*—its total weight was 8,140 pounds at the take-off—was unaided by even a breeze. If anything there was a slight tail wind. Captain Hermann Koehl, who flew heavy bombers during the war and who since then has spent much of his time flying almost equally heavy passenger transports, was at the controls. The ship had used nearly all of its runway, the tail was up, the wheels barely touching the grass and Koehl was raising her carefully, by inches.

Then a sheep appeared on the runway and started to browse directly in the path of the nine-foot propeller. Koehl saw the animal, lifted the ship, and made it. There was another obstacle, a large tree, just ahead but the all-metal plane was climbing now and cleared it by a matter of a yard or less, or so it

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seemed to the little group of Irish Free State officers and their friends who had gathered at the airdrome for the start.

Among those who had gathered for the take-off were William T. Cosgrave, President of the Free State Executive Council, and Mrs. Cosgrave, Herr G. von Dehn, the German Consul General in Dublin, Mr. Desmond Fitzgerald, the Irish Minister of Defense, and brother officers of Major Fitzmaurice.

With Captain James Fitzmaurice (since then elevated by the Irish Free State to a majority in recognition of his accomplishment) pointing out landmarks, and Baron Guenther von Huenefeld, whose reckless energy, personal fortune and enthusiasm for flying had made the attempt possible, more or less buried among the benzol tanks in the dark fuselage, Koehl drove the low-winged monoplane for the Galway Coast and thence along the coast toward Slyne Head Light and out to sea.

Slyne Head was the last land they saw until daylight the next morning thirty hours later and the first half of the water jump was uneventful. Variable winds prevailed, and for the first 400 miles after leaving land the weather was fair. Sometimes the wind helped them a bit coming from the east and south-east. Then it would veer into the west for fifty or a hundred miles but it was never strong enough to give the fliers either great joy for its assistance or anxiety because of its opposition. From time to time they corrected drift by dropping smoke bombs and circling as they watched. According to Fitzmaurice they also obtained a very fair estimate of wind velocity by this maneuver. Their speed for this part of the trip they estimate at slightly better than 100 miles an hour.

About four hours out they encountered their first change in weather and from that time on until within 400 miles of Newfoundland or as it turned out, Labrador, they ran into frequent snow and rain storms and cloud banks. None of these were extended over a big region. Some of them they drove through and they went around others.

One incident occurred to break the monotony of the endless expanse of blue sky and sea during that first morning. The motor sputtered! But it was nothing of importance. One of the pilots in adjusting his mixture had "leaned" it a trifle more than the Junkers L5 could stand. This was remedied quickly, and the *Bremen* continued serenely on its way into the west with first Koehl doing the flying and then Fitzmaurice, each pilot taking the stick for about three hours at a stretch. As the load came slowly down away from the danger point they began to frequently change their altitude, seeking out levels close to the water when the wind shifted for a time into the west, and going higher to get as much help as they could from the wind when it favored them. Thus they ranged up and down from fifty feet to two thousand.

There was little for the Baron to do. Now and then he passed out coffee and meat sandwiches. Some of the time he slept and again busied himself with his pen writing verse or prose, seeking to set down for posterity just how it felt to be the first passenger ever to fly westward across the North Atlantic. Hitherto, while preparation for the flight had been going on, his dynamic energy had been expended to the utmost and now the enforced inactivity began to be trying. At 5 o'clock in the

afternoon he stepped to the door leading into the cockpit, his monocle at its most formal and proper pitch, and announced "Tea."

About this time the wind came about into the southwest. For some time it had held steadily from the southeast, gradually increasing in velocity until the white caps were piling up below them.

Then as the sun was climbing all too fast down the western sky trouble loomed up ahead. The wind increased in violence and shifted into the southwest. As close as they could judge they were about 400 miles out from the North American coast for ahead was the first real fog they had encountered. It blanketed the water below them and reached up like the Himalayas above them. They started to climb the ship and went up to 6,000 feet without being able to get over it. Then it grew cold and they went down again, down to within fifty feet of the waves where the going was exceedingly bumpy.

It was in this situation that darkness overtook them and affairs were further complicated by the discovery that their lighting system was not functioning, leaving their instrument board in darkness. Now and then they used a flashlight but only for moments at a time. They did not dare to stay so close to the water here because they knew that they were approaching land so up they climbed again to 6,000 feet. These hours in the clouds and fog and cold proved one thing of great importance it is believed. Either ice does not form as easily on the corrugated duralumin leading edge as on some other forms of construction or the thick coating of paraffin which was painted

on just before the take-off or the combination of corrugated metal and the oil was an efficient defense against it. Further flights, not necessarily transoceanic, of course will be needed before this theory can be accepted by builders as absolute fact. The idea is interesting, the results of this test encouraging.

The night wore on and finally they flew out of the fog and saw the stars from which they at once discovered that they were still flying westward.

For two hours more they kept to the westward course although they knew that they should have crossed from sea to land some time before. Then with the help of flares they discovered that they were over land. For some time both pilots had been watching broken patches of what they thought was low fog. By the flares they learned that they were over vast snow covered forests and rolling hills with mountains ahead.

The fact that they were over Labrador indicates that during the hours of blind flying they had been steadily making nothing. When they should have bent their course to the southwest they were probably not willing to trust their compasses which had been showing the effects of the magnetic changes and so they kept on. The head winds had been causing them to use up more fuel than they had figured and at times they were running their motor to the point where their airspeed showed 130 miles an hour. Such a speed eats the gas.

Shortly after sunrise the fliers came to the conclusion that they were many miles inland over Labrador and they swung around into the southeast holding on this course for four hours. Thus they arrived over Greenly Island, saw the lighthouse,

circled and came down to a landing on a tiny reservoir in its center. Koehl made a perfect landing but the ice failed and the ship nosed over.

They had been thirty-six hours and thirty minutes in the air. They had crossed 2,000 miles of open water and, while exact data is not available, they probably cruised over 800 miles of land striking Belle Isle Straits one or two hundred miles to the south of the point where they left the sea for the land.

The rest is well known; how the light keeper, Johnny Le Tamplier, his buxom wife and six children, to say nothing of a dozen or so Newfoundland puppies and sled dogs, rushed out to greet them, how they were made at home at the Le Tamplier fireside while Johnny sent word to the Point Amour wireless station several miles across the straits on the mainland.

They landed about 1 p. m. on April 13 Eastern Standard Time, but it was 7 o'clock that night before the waiting hundreds at Mitchel Field whose numbers had dwindled from thousands in the last hour before darkness learned that they were safe even though 1300 miles from their announced destination.

At once Miss Herta Junkers, the energetic daughter of Dr. Hugo Junkers, now on his way to this country, started to organize a relief expedition, although it was not known in New York just how much the *Bremen* was injured.

Preparations to start planes northward were made at Curtiss Field, at Hartford and by the Canadian Transcontinental Airways. On the evening of the fifteenth a Junkers mechanic started north by train taking with him a complete landing gear for that of the *Bremen* had been badly damaged. Struts and

wheels were bent and the axle was cracked. The propeller tips also were bent.

After several attempts made abortive by storms Duke Schiller and Dr. Louis Cuisinier flying a Fairchild-Pratt and Whitney "Wasp" job made the flight to Greenly Island and the next day he started back with Fitzmaurice for spare parts. They were forced down at Natashquan on the Banks of the St. Lawrence but two hundred miles from Greenly.

It was April 18 when Duke Schiller finally set his plane down on the ice of St. Agnes near Murray Bay where Fitzmaurice made known the needs of the fliers and their ship to Miss Junkers.

Meanwhile the Ford expedition, Floyd Bennett's last flight, was getting under way at Detroit. Both Bennett and his fellow flier, Bernt Balchen, left hospital beds to fly the tri-motored Ford into the frozen north. When they landed at Murray Bay on April 20th, Bennett had to be helped from his plane and two days later he was lying in a Quebec Hospital close to death. He was not destined to live to see the accomplishment of this rescue expedition but Balchen carried on.

April 23 he took off, with a heavily loaded plane carrying benzol, spare parts, Ernest Koeppen of the Junkers Company here and Charles Murphy. He landed at Greenly. It was found that the engine of the *Bremen* had suffered from exposure and that take-off conditions for wheels were impossible, so regretfully the German-Irish crew decided to abandon ship until a later date and fly down in the Ford. They landed at Murray Bay, April 26, to learn that Bennett had died the day before.

At once a pall of gloom enshrouded everyone. The *Bremen's* crew decided that they would go on to Washington for the funeral but at New York, because of storms, they left the Ford ship and went to Washington by train, too late for the services. The next morning after laying wreaths on the grave, they returned to New York. In so far as possible they avoided greetings on that day, Saturday, April 28.

The reception on April 30 was unique. Not so boisterous as Lindbergh's, not so noisy as that to returning troops after the war.

But it had its own great significance. It brought home to the millions who took part and to the Irish-German crew of the *Bremen* that peace between great nations had come again.

Transatlantic flights may be useless stunts as far as aviation is concerned. Some "experts" avow this over and over but the great gift of aviation to the world is clearly realized in them because it so graphically illustrates how the airplane brings peoples closer together.

A word about the ship itself and its motor. The *Bremen* is a Junkers, type W33, low wing, cantilever, monoplane powered by a Junkers 285-310 horsepower six cylinder in line water-cooled engine. It has a span of 58 feet 6 inches, a length over all of 34 feet 6 inches and a height over all of 9 feet 6 inches.

Its weight empty is 2640 pounds, useful normal load 1990 pounds, total load 4630 pounds. Its wing area is 463 square feet, wing loading 10 pounds to the square foot, power loading 15 pounds to the square foot.

For the ocean flight its total load was 8140 pounds, wing loading 17.6 pounds, power loading 26.2 pounds.

It has a normal high speed of 123 miles per hour, but can be pushed faster. Its cruising speed is 97 miles an hour, landing speed 53 miles per hour. Its ceiling is 19,000 feet and its actual climb from 3300 feet to 6500 consumes 5 minutes and 30 seconds.

The Junkers Aero engine L5 is a recent development of the Dessau laboratories. Its weight is 690 pounds. The six cylinders have a bore of 6.3 inches and 7.5 inch stroke. The fuel used on this flight was a 90 per cent benzol compound and the engine was adjusted for this fuel with a compression ratio of 7 to 1. Its standard compression ratio is 5.5 to 1.

This engine draws the intake air to the carburetor through the crankcase. Additional warming is provided by water jackets on the carburetor bodies. A double throat Zenith carburetor is used; it has an auxiliary air control for altitude flying and for economical cruising when flying with a partially closed throttle.

The fuel load for the ocean flight was slightly over 600 gallons.

THE BYRD ANTARCTIC EXPEDITION

BY RUSSELL OWEN

BEFORE another month has passed the auxiliary ship *Samson*, which will carry the Byrd Antarctic Expedition to the Ross Ice Barrier, will have arrived in New York and the assembling of the planes, stores and personnel of the expedition will be well under way. It will be the first time that airplanes have been taken into the Antarctic and because of them it is probable that more will be accomplished in a relatively short time than has been done before in the many painful years that men have struggled on foot over the desolate southern wilderness.

Commander Richard E. Byrd, whose flights over the North Pole and the Atlantic are now a part of aviation history, will take at least three planes with him. His most important ship will be a new and specially built three-motored Ford. There are several reasons for his not using the Fokker tri-motored plane this year, the most important of which is that the Ford wing can be disassembled and packed away in much smaller space than the one piece wooden Fokker wing. When so much material has to be stowed on a ship as small as the *Samson* this is an important consideration.

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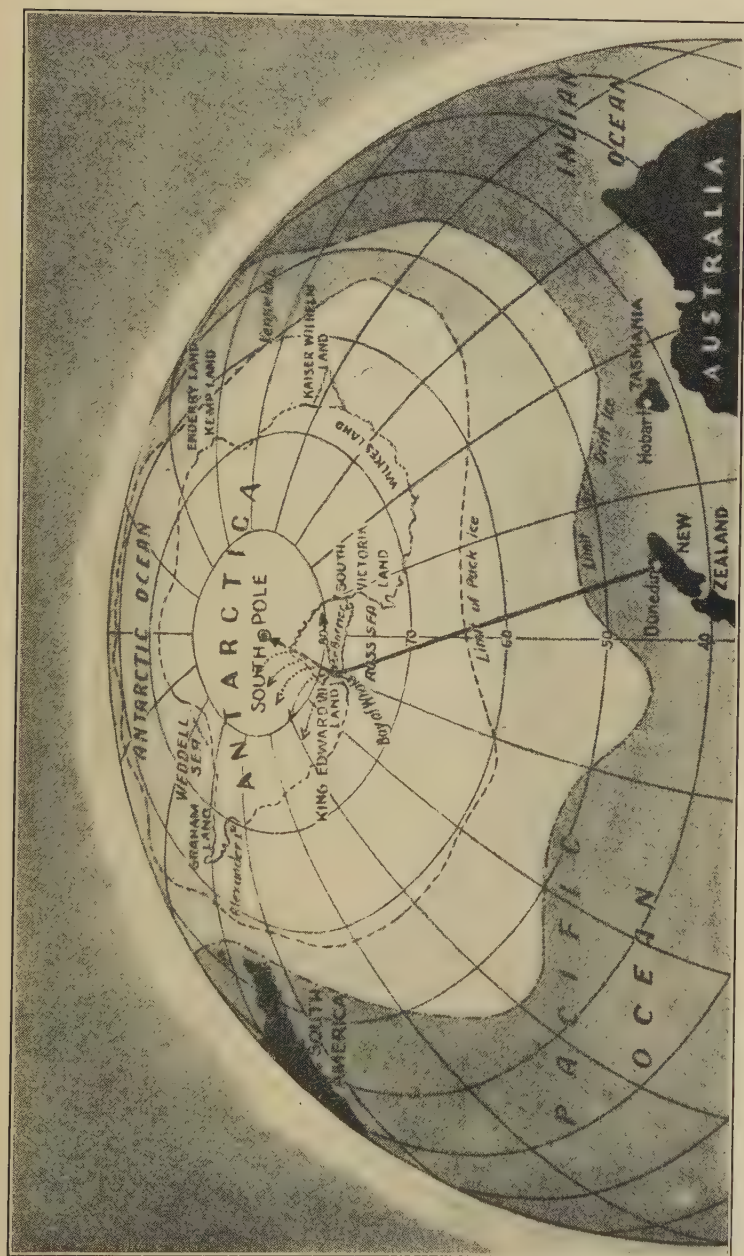
The Ford is built of a much thinner duralumin than the standard commercial planes, and several hundred pounds have been taken off in this way. The wing spread is also greater, measuring 78 feet, and the combination of larger wing and lighter material has given the plane a quick take-off and rapid climb. With a load of several hundred gallons of gas at the Ford airport it got off the ground in five seconds, much to the delight of Floyd Bennett, Byrd's second in command and chief pilot on the expedition. The first tests of the plane indicated that it was well suited to its task.

Another plane to be used is a Bellanca monoplane, which has been tested on skis in Canada and showed good performance. The Bellanca has a cruising radius of 3,000 miles, and the Ford about the same, although it is not probable that they will be loaded to full fuel capacity on the Antarctic flights. Byrd's longest flight, that to the South Pole and back, will be about 1,400 miles less than his North Pole flight, but under conditions just as dangerous. A third plane with a short cruising radius will be taken for scouting for airplane bases which can later be put down by dog sled.

The flight to the pole will be the least of Commander Byrd's achievements if he carries through his full program of exploration. He intends to make many side trips into the absolutely unknown land east of King Edward VII Land, where there is a stretch of coast 2,000 miles long which has never been seen or charted. He will not be able to explore it all, but with side trips from his bases along the line of the polar flight he will be able to clear up a great deal of the mystery of what lies in that blank white space on the map.

It is because of this that Byrd has an opportunity to do much more scientific work on this trip than on his North Pole expedition. Although he did survey on that trip a part of the polar basin never before seen, he traversed a relatively small part of it. In the Antarctic there are 4,600,000 square miles of unknown territory, and Byrd should be able to observe and to some extent map a considerable extent of the quadrant to the east of his main base. Just what he will find there nobody knows. It is not known whether the Antarctic continent, which is really a vast ice cap, rests on islands, water or on two huge bodies of land. It is possible that between the Ross Sea and the Weddell Sea there is a great ice stream which would show a division between two continents, and if this can be established it would be a great contribution to geographical knowledge. In the other parts of this sector which Byrd can reach by a series of 500-mile flights there may be volcanoes, mountain ranges, all sorts of formations which would give some indication of the land beneath the ice.

No greater proof of the value of airplanes in exploration could be offered than the possibilities of discovery which lies before Byrd compared to the relatively small areas explored by Amundsen, Scott, Shackleton and others who have risked their lives on foot over hundreds of weary miles. Byrd will face great dangers also, but they will be dangers of flying in a country where snowstorms driven on terrific winds spring up in a few hours. But with good fortune he will be able from his elevation of thousands of feet to see scores of thousands of square miles of virgin territory on which men have never looked, and do it in a short time.



Plan of the Route of the Byrd Antarctic Expedition

His base is ideally situated for his purpose. It will be on the Ice Barrier at the Bay of Whales, an indentation in the barrier where the ice is low enough so that it will be easy to unload the planes and supplies. At other points the barrier rises to a height which may be 280 feet, a glistening white cliff which has effectively repelled invasion. In most places the barrier rests upon the water, and the outer edge retreats or advances with the years. But at the Bay of Whales it apparently rests on solid ground, for it has not changed its position there in many years, and Amundsen came to the conclusion that it was anchored there. At least it was safe enough for Amundsen to spend a winter on it about ten miles back from the shore line, and Byrd will also pitch his tiny village there.

The main base in this case will be near the eastern edge of the barrier, and the central point from which flights diverging like the spreaders of a fan may be made back of King Edward VII Land. And if it is desired to extend these flights farther south toward the pole, the bases, which will be laid down at 100-mile intervals until the polar plateau is reached, may be used for the same purpose. These bases also will serve as emergency stations, in case the plane is forced down by a storm, and Byrd, Bennett and Bernt Balchen, who will be the third member of the crew, have to walk back.

Flying conditions on the ice barrier are expected to be fairly good in the summer time. There may be some fog, and there are certain to be snowstorms and wind. Amundsen reported only two severe storms while he was there, but the Antarctic

weather is about the most uncertain thing in the world. When it does blow it blows more than 100 miles an hour, and the snow comes down off the plateau by the millions of tons, until the air is almost fluid with it. If the fliers encounter a storm of this kind there will be nothing for them to do except land and dig in until it is over, with a bare possibility of being able to get the plane off again.

The worst of these storms will be encountered over the edge of the plateau, where the cold air rolls down from the dome-like cap, gaining momentum as it comes. The ice barrier runs into the continent toward the plateau in shape roughly like a triangle, and around the edge the storms die down about 25 miles after they reach the ice barrier, which extends to within about 400 miles of the pole itself. So, although flying over the barrier may not be so difficult, there is no telling what will be encountered when the plateau is reached, and the plateau goes to an elevation of more than 10,000 feet.

At the South Pole itself, however, the air will be comparatively calm, due to a definite meteorological condition which always exists there. The cold upper air flows on all sides toward the pole and then drops downward because of its greater weight, to again flow outward and downward off the dome. When Byrd is flying toward the pole he will know when he reaches this downward current by a sudden sharp drop in temperature, and once past it he will be in a region where the wind flows gently all ways at once because of its general downward direction.

So on the barrier and at the pole conditions will be much

better than along the edge of the plateau, or over the mountains which are believed to fringe the Antarctic ice barrier to the eastward. There he will meet as dangerous conditions as a flier has ever faced, and it will be a severe test of planes and engines. Wright Whirlwinds will be used on all planes. They will probably be cowled in even more than on the North Pole plane, and they will be started in the same way by heating them with a gas stove at the end of the long fireproof canvas funnel.

Byrd is going to equip the plane for every possible emergency. He will be able to carry more equipment than on his North Pole flight, and it is possible that he will be able to take a few dogs and a sled in the plane with him, as well as quantities of emergency rations, a tent, skis and other necessary articles to use in a forced landing. He is none too optimistic about his chances of getting back, however, unless he lands within a reasonable distance of one of his emergency bases.

As the scientific work of the expedition will be its most important achievement, a number of scientists will be taken on the *Samson*. There will be a geographer, who will also be a geologist, a meteorologist, a physicist and possibly an ornithologist, and ichthyologist. They will make side trips and investigations while the flying is going on, and if the expedition spends the winter on the ice barrier they will be able to obtain a great deal of information about this mysterious sheet of ice. Byrd himself will carry special cameras for surveying, which are being built by the Fairchild company, and map as much as possible of the unknown territory by camera.

In the expedition when it leaves New York there will be fifty-five men, including the crew of the ship. There will be one or two Norwegian veterans of the Antarctic. The others will be mechanics, another pilot or two, radio operators and other men necessary to carry on the details of the expedition. Special short-wave radio sets will be taken, and by means of them it is believed that direct communication will be maintained with *The New York Times*, which has purchased the rights to Commander Byrd's story, as this newspaper did with Peary, Scott, Amundsen, Lindbergh, Chamberlin and other explorers and aviators on their historic trips. It will be the first time that direct radio communication has been maintained with an Antarctic expedition, and the first time that news of every important movement of such an expedition has been sent to the world a short time after it occurred.

The *Samson* will probably leave New York early in September, and may not return for a year and nine months. It will depend entirely on how soon the ship can fight its way through the ice pack which lies off the Ross Sea. Byrd hopes to get through to the ice barrier by December 15, but he may not make it until early in January. That will leave him only two months to get his equipment ashore and set up, for the winter season begins in March, and the *Samson* will have to put back to New Zealand to avoid being crushed in the ice.

Two months is a short time to do all Byrd wishes to accomplish, and he may be checked by the weather, so the chances are that he will be forced to spend the winter on the ice barrier, and start in again early the next spring.

ADVENTURING INTO THE ANTARCTIC

BY COMMANDER RICHARD E. BYRD

THE long, tiresome and yet interesting days of preparing for our Antarctic adventure are over at last and we are about to start south. What may be ahead of us no one can foresee. We have prepared as carefully and as thoroughly as has been possible, but the Antarctic has ways of playing strange tricks on those who invade her desolate icebound coast and it may be that we shall seem to fall short of what may be expected of us.

But I do not think so. If the skill and courage and resourcefulness of the men who are going with me to live more than a year on the ice are what I believe them to be, the expedition will give a good account of itself. We shall do our best. We are attempting a new kind of exploration in a little known part of the world. We should be able to learn more of the Antarctic in two short seasons than all the brave and able men who have suffered or given their lives in other expeditions.

Even a superficial glance at the region that we hope to penetrate will show why that is so. Nature has guarded the secrets of Antarctica by locking them within a wall of ice, and

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clothing the land with a white desolation in which no living thing exists. When man forces his way on foot into this great wilderness, he attempts the most difficult task that can confront an explorer. Shackleton, Scott, Amundsen, Mawson, all those who have made such a glorious record in the Antarctic, pitted the strength and endurance of their bodies and their wills against odds that seem almost insuperable. And yet they conquered as much as man can conquer when he relies on his own unaided physical capacity. We are more fortunate in having the wings of science to carry us quickly over the snow through which they laboriously forced their way.

The Antarctic has always fascinated those who have been there. It is bounded by a belt of floating ice, a drifting, shifting mass of treacherous floes through which ships must pick their way carefully. Sometimes the belt is held fast for days at a time. While a ship is icebound, sleet and snow sweep by on the gale, and the explorer is wrapped in a gray shroud of storm that seems to warn him that he is venturing on forbidden seas.

And then one day the sun shines, the storm passes and the ship finds its way through the ice and comes out into the vast Ross Sea, where whales play and the light shines on great icebergs. Through this sea, which lies between promontories of the Antarctic Continent and which is one of the few places where the land may be safely approached, we shall sail until the great ice barrier rises before us.

That barrier has been a symbol of the Antarctic since Sir James Ross first found it and coasted along its precipitous

front. It rises as high as 250 feet, a solid mass of cliff-like ice, which seems effectually to shut off the interior. It rests most of its length upon the sea and parts of it break off and drift away in the form of those vast tabular bergs which are peculiar to the South. Some of them are many miles long. It would be impossible to winter on the ice barrier because of this danger, even if one were able to scale the cliff at more than one point.

That point is the Bay of Whales, an indentation in the ice barrier which gets its name from the schools of whales found there. Amundsen picked this bay for his Winter quarters because he shrewdly suspected that the ice there rested on land. He discovered no movement during his Winter stay and the charts of the ice barrier indicate that, although it advances and recedes at most points, and is now receding, it is fairly stationary at the Bay of Whales. The bay ice also has the great advantage of being only a few feet above the water, so that it is possible to discharge a ship there by mooring it to the floe.

When we step ashore there we will see before us a mile or so of sea ice, then a gently rising slope glittering white in the sun and extending inland as far as the eye can reach. Far to the left are the heights of King Edward VII Land and to the right the undulating capes and promontories of the ice barrier. There is little wind at this point and the silence is broken only by the cries of gulls and petrels. Seals bask on the isle and the droll penguins cock their heads to one side and walk up to the queer visitors—the explorers.

Before us will lie, wrapped in its mantle of ice and snow, 4,600,000 square miles of almost unknown territory, an area as large as the United States and Mexico. A few paths have been painfully blazed through this land by Scott and Shackleton along the western side of the ice barrier toward the Pole and by Amundsen due south to the Pole from the Bay of Whales. The edges of the Weddell Sea, Graham Land and a few other places on the circumference of this vast area have been charted, but the bitter cold, the treacherous storms that blow with a greater violence there than anywhere else in the world, and the complete absence of animal or plant life have prevented men from gaining any real knowledge of the continent.

I have been asked many times why we are going to the Antarctic, what we can do or learn there which will justify the expense or danger of such an expedition. This is a hard question to answer, not because there is any doubt in my own mind or in the minds of the scientists who are accompanying or advising me as to the value of the trip, but because the significance of data which may be obtained is far removed from popular knowledge and experience.

Why did Peary labor for years to reach the North Pole? Why did Nansen, Nordenskjold and Amundsen, Greely and Franklin and many other men, spend years and some of them sacrifice life itself to penetrate the Arctic Sea? Why did Scott spend five years in the Antarctic and lay down his life there in one of the most noble and dramatic chapters of polar exploration? Why did Shackleton return again to this desolate

region to die finally from hardship and exhaustion? Why did Mawson struggle for a foothold on the frozen threshold of the Antarctic in gales that lasted all year? Why do scientists go again and again to the frozen North and South and spend weary months in seeking to reveal some of the secrets of these mysterious regions?

The human answer to these questions is simple. Men do these things because they are men; because in the unknown lies a ceaseless challenge to man's curiosity, to his ever-expanding fund of knowledge. While anything is to be learned of this earth of ours, of its form, its history, its strange forces, men will be found who will not rest until that knowledge is complete. That man himself advances, that life is better worth living now than it was in medieval times, that we have radio and moving pictures and flying machines, is due to this driving force in man which will not let him rest. Some men invent things which add to the comfort of life, some delve into the secrets of nature in laboratories that we may have electric lights and better food and machines which heal our bodies. Some men explore unknown lands and seek to solve in them the riddles of nature, that we may have a more complete and nobler comprehension of our world.

The mere fact that on this earth of ours is a region larger than our own country of which nothing is known is a sufficient motive for our trip. So long as that great space remains unexplored, men will attempt to penetrate it. America should have its share in that work. We cannot hope to complete it, although we hope to do more than has been done before

because of our airplanes. There are many interesting speculations with regard to the interior, and geologists have long been puzzled over some of the contradictory features of the known landscape.

Is the Antarctic one continent or two huge islands? It is known that the polar plateau rises to 10,000 feet in the interior and that there are two large mountain chains running inland from the Ross Sea and at either side of the ice barrier. But opposite the Ross Sea is another indentation in the continent, the Weddell Sea, so similar in appearance to the Ross Sea, so apparently related to it in position that there has long been speculation as to whether or not these two bodies of water did not at one time meet in a strait which has since become overlaid with the ice of the polar plateau. Nobody knows how deep is the ice covering, and it is probable that a careful survey from the air would show that there once was a connection between the two Antarctic seas and that the continent of ice was two large islands before the Ice Age.

It is probable that we shall also be able to determine whether one of the mountain ranges is actually a continuation of the Andean Cordillera. The interior of King Edward VII Land, or rather that part of the interior to the southeast of that land, has never been seen, and if we are able to penetrate it some distance by air, we shall learn definitely the trend of the mountains, or perhaps discover an undulating plain. That is one of the greatest geographical problems of the Antarctic.

There are many other things to do, of which flying to the South Pole is far from being the most important. The pur-

pose of the flight to the Pole is not only to reach the Pole itself but to survey as much of the polar plateau as possible, something which Amundsen and Scott were unable to do because of the limitations of their method of travel. My greatest desire in going to the Pole is to fly beyond it, if possible, and ascertain the extent of the plateau and its physical characteristics. It is probable that it extends for many miles in an undulating plain, but nobody knows. It has never been approached except from the Ross Sea sector.

All of this country over which we fly will be mapped with the aid of aerial cameras, specially constructed instruments which will record a wide territory on each side of our routes, the size depending on the height we are able to attain over many elevations of the landscape. From these photographs maps will be drawn which for the first time will give nearly accurate details of the country. Although mountain ranges have been glimpsed at a distance by expeditions in the Antarctic, their actual position and detail have never been accurately ascertained.

There are many problems for the physicist in auroral observations, earth radiation, radio-activity of snow and ice and glaciology. There are meteorological studies to be made, perhaps as important a task as anything else, for the Antarctic cold and storms affect the climate of half the world. There are studies in magnetism and spectro-photography, and the causes of that little-understood phenomenon, the aurora australis. It is believed that it is the result of an electronic bombardment from the sun under which certain atoms are broken up, but that also is speculation.

Fossils are to be sought, and rock specimens will be obtained for careful examination. There is much valuable experimental radio work to be undertaken. There is almost no limit to the scientific work which may be done in the Antarctic; for, despite the accomplishments of Scott, Mawson, Amundsen, Shackleton and others, the surface has been merely scratched.

Our geographical work will be controlled almost entirely by meteorological conditions. Airplanes have never been used in the Antarctic, and any one who uses them there must begin his work with somewhat the feeling that he is going into danger. The reports of Antarctic blizzards would cause the most adventurous spirit to become cautious. It is obvious that flying should not be a slap-dash proceeding in a region where winds rise from dead calm to forty miles an hour in two minutes, and out of a sky that had been clear, carrying blinding clouds of snow through which it would be impossible to fly safely. It can be understood why we are taking four planes. We shall be extremely fortunate if we bring them all back.

Our testing and early flying in laying down bases will be comparatively simple. We shall have an opportunity to test our skis under loads, for the weather at the Bay of Whales is unusually uniform and free from storms. This is due to the unusual formation of the ice barrier, which is a vast triangle, 600 miles long at its sea base and running inland about 400 miles. It is believed that this offers a zone of comparative calm because of the peculiar nature of the storms which roll down off the high polar plateau, the largest plateau of similar height in the world.

Professor Hobbs of Michigan believes that the strong winds on the edge of the continent are caused by the gravitational force of descending currents of cold air, but that on the barrier these winds are checked by their own pressure within a few miles of the interior edge of the barrier. Whatever the reason for this phenomenon, it seems certain that on the barrier we shall have an unusually good base for our planes.

But once we pass beyond this region in flight we enter meteorological conditions that are uncertain and dangerous. The flight to the Pole will indicate what I mean. It seems reasonable to assume that from the edge of the barrier, where our main base will be located, up to the glacier over which Amundsen made his way at the edge of the plateau, the flying will be in fairly smooth air and with little danger of a sudden storm.

This is fortunate, for it will give us an opportunity to climb slowly with our heavy load to an altitude of 12,000 feet or more, which we need to cross the mountains and the plateau. We may, of course, take off from a base at the foot of the plateau, but this must be decided by conditions as we find them.

The moment we reach the mountains, we enter a storm area. Winds howl down the passes in the mountains from the plateau, bearing dense clouds of snow through which it will be difficult to fly. The air is turbulent and the velocity of the wind such that we shall literally have to fight our way through it. This will tax the plane and the pilots to the utmost, unless it is possible to climb above the storm, and I very much doubt

that we will be able to avoid all of it. Just how far this storm area may stretch it is impossible to tell, and it is barely possible that we may reach the mountains in one of those strange periods of calm which are almost as inexplicable as the storms themselves.

But once through the mountains and well into the plateau, it is probable that we shall encounter merely moderate winds and little snowfall, which should make this part of our journey favorable for exploration of a part of the plateau and for close examination and for photographing of the mountains seen by Amundsen, to which he gave the name of the Queen Maude Range. Whether we shall be able to alight at the Pole and make observations on the ground is problematical. I should like very much to do so and possibly prolong our stay there a day or two, but this will have to depend entirely on the surface we find and the ability of the plane to rise with a load from an elevation of more than 10,000 feet, which, as every aviator knows, is very difficult even under the most favorable conditions. We are still held by the present limitations of aircraft.

A flight to the east and southeast over the mountains that are supposed to exist to the east of the barrier will be a very different and much more difficult trip. There we will be over absolutely unknown land, flying directly into the path from which come the pressure waves that control to a large extent the storms of Antarctica.

The origin and cause of these waves are unknown, so we shall have the condition of flying over an unknown area, never

before seen by man, toward the threat of storms which we can neither anticipate nor avoid. In these side-flights, however, may lie the greatest successes of the expedition, as they will result in the mapping of a vast territory hitherto unknown, and so they will be worth all the risk.

They will not be long flights, of course, and will be started from inland bases, so that it will be possible to dash out and back again as a precaution against being caught in a storm. Every flight will be over a predetermined route which will be held to rigidly, so that in the event of a forced landing the crew may be rescued by another plane. It can readily be seen that a sudden storm with snow would blind the pilot so that it would be impossible to keep going, and if he should be caught in a storm there would be only two possible manœuvres—either to land at once and wait until it was over, which would be safest, or try to beat the storm back to the base. That might be possible, as the pressure waves move at a velocity of only forty miles an hour, and, fortunately, directly toward our main base. It is for this reason that the Bay of Whales offers, of all known parts of the Antarctic, the best base from which to direct operations by air.

It can readily be seen that flying in the Antarctic is very different from Arctic flying. There are few storms in the Arctic during the Spring months, but there is the constant danger of fog. In the Antarctic, on the other hand, there is little fog but constant danger from storms. There is no other part of the world where the weather is so uncertain, or rather, so certain in its constant menace. In the Arctic, also, it is

possible to fly at a low elevation above sea level, which makes it possible to utilize the full efficiency of the plane, but in the Antarctic nearly all flights must be at a height of many thousands of feet above sea level, which limits the capacity of the plane and makes forced landings with a load very dangerous.

There is the satisfaction of having a solid surface instead of floating ice on which to come down; but Antarctic cold is much more severe than that of the Arctic in the Summer months. In the Antarctic it never gets above freezing. In flying, of course, lower temperatures would be encountered.

We hope to carry out most of our extensive program, and believe that we shall be able to do so. The personnel of the expedition is all that could be asked; no better men ever went into the Antarctic. I have every confidence in them and am proud to be at their head. Our equipment is of the best, both aeronautic and scientific. Nothing which foresight could provide has been overlooked. And so we push off in the hope that we shall be able to accomplish all that is expected of us, and that our expedition will carry a step further the glorious tradition of achievement which has already been made in the Antarctic.

RIDING THE NIGHT SKIES ON THE WINGS OF A PLANE

BY T. J. C. MARTYN

EACH night when you are probably tucked away safely in bed the night pilot wings his way through the air with the mail and perhaps a passenger or two. Across lakes and rivers, over towering mountains or vast plains, through the silvery moonlit air or under the yawning star-studded sky, in fair weather and in foul, he carries out the bravest and greatest duty of commercial flying at speeds that make snails out of the fastest trains.

If flying at night is theoretically the same as flying in the daytime, in practice it is vastly different. In daylight there are those infinite combinations of cloud and wind and temperature conditions that mean good, fair or bad weather. At night each condition varies according to the fullness of the moon, giving rise sometimes to some of the most beautiful and awesome sights to be seen under creation. And then there is the dark period, when there is no moon and when, every now and then, there is nothing whatever to be seen—for you are flying through the blackest of black fogs.

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In the daytime one good flying day may be said to differ little from another, wind and temperature being equal; but at night any given weather conditions has at least two phases. There is literally a world of difference between flying in a clear, dark night, when only the stars in the heavens and the lights on the ground are visible, and under a full moon, when the ground is seen almost as clearly as in daylight.

If you ascend in a plane on a clear, moonless night over New York you will see a sight hard to match for its brilliance. You will see in an ebony setting many diamond-studded lanes across the East River—Brooklyn, Manhattan, Queensboro and Hell Gate bridges—and to the west a myriad of luminous beetles, apparently motionless—the boats on the Hudson River. At the Battery there is a small cluster of lights in the deserted downtown skyscrapers and Broadway is to be seen with difficulty as a line of faint lights. Between City Hall Park and the Thirties Broadway is no more, but from Thirty-fourth Street it reappears in a burst of illumination and can be traced as a line of evenly spaced lights intersecting other straight lines of lights, until at Forty-second Street it merges into a flooding glow of brilliance. The Great White Way is greater and whiter from the black sky than it is from the ground, distance lending enchantment to the view. And finally the lights grow dimmer and lose themselves in the gloom of distance. In the middle of the island Central Park's location will be faintly discernible from the irregularity of the lights that dot it, while skyscrapers, viewed obliquely, rise up like giant illuminated honeycombs.

Get away from the city, far out into the country, away from the towns and villages, and all you will see is the occasional light of some remote house, the glow from a railroad locomotive reflected in its smoke, or a motor car with bright, searching eyes going along the road. Elsewhere the earth is invisible and you gaze seemingly into a vast, bottomless void—no trees, no roads, no rivers, no railroads, no buildings, no anything; just an enveloping inky blackness perforated above by the stars and below by occasional pinpoints of artificial light.

But there is one sight that is only to be seen in its full brilliance on a dark night, and that is a busy airport. The lights of an airport are often to be seen from great distances, and as you get close to them they appear as a fairyland, or as Coney Islands or Palisades—which themselves present very beautiful spectacles from the air. The airport will be first distinguished by the dazzling floodlights that bathe the surface of the landing field in a light many times stronger than the daylight. These are powerful searchlights trained on the field so as to provide a wide area of illumination. Sometimes a narrow path of light is preferred and this is lit by a single searchlight into which the planes land and from which they take off. Under the floodlight system planes can land almost anywhere in the lighted area.

Then there are the hangars. They, too, are lighted, inside and out, and all other buildings and natural obstacles carry a light to distinguish them in the dark. Sometimes a searchlight is to be seen sweeping the sky, its great white beam making its inky surroundings even blacker. But for the most part

you will see only the humbler landing lights of an emergency field and the great beacons flashing their seeming pinpoints of red or white lights to guide the night pilot on his way.

How different is the view on a clear moonlight night! The city lights are still there, but robbed now of their brilliance by the sheen of the moon. The outline of Manhattan, its streets, its massed buildings and its parks are all visible. You will see the East and the Hudson and the Harlem rivers as streams of purest silver dotted with boats that now look like gray driftwood rather than beetles. Central Park appears as a ghostly wilderness of shreds and patches. If you gaze closely at the scene from 2,000 feet, which is the lowest you may come down to, you will see the automobiles along the streets.

In the open country the aspect of the scenery undergoes a remarkable change—the view is now identical with that seen in the daylight, except that the outline of everything is softened by the flooding moonlight. Nowhere is that fabled charm of the moonbeam more felt and appreciated than in the air, and nowhere will you feel more the silent majesty of the earth bathed in a poetic and alluring beauty beyond expression. Rivers like ribbons of silver, roads like long, winding, criss-crossed ribbons of white silk, forests shading from greenish gray to jet black, houses, towns and hamlets shrouded in an almost visible silence, railroad tracks like endless serrated bracelets of shining platinum—such are the views on which your eyes will feast, and more than at any other time in the air the sheer magnificence, the exotic beauty, and the phantasmagorical unreality of the landscape will sweep you through space far from the din and actuality of the ground.

It is often said that bad weather is bad weather and whether you are flying through it in daylight or darkness makes little difference. This is truer in the moonlight than in the dark period; for there are few nights that the moon fails to pierce the clouds or the fog sufficiently to relieve the darkness, just as the sun relieves the shadowing storm sky in the daytime. But on the moonless night, if ground and sky be obscured by storm clouds or mists, there is nothing but a Stygian darkness impenetrable on all sides of your plane, above and below it. Navigating by night in such weather is no joke and the strain of it broke more than one man's nerve during the war; for it is difficult to escape the feeling of acute isolation and loneliness that restricted vision entails for some men. But usually the pilot is too busy watching his instruments to be distracted by such sensations; it is only after the flight that the strain begins to tell on him.

It will naturally be assumed that flying by night is more dangerous than flying in the daytime, and it is useless to deny it. It must be remembered, however, that night flying, relatively speaking, is still in its infancy; a great deal remains to be done to improve equipment and training methods for personnel. Nevertheless, the dangers of night flight are easy to exaggerate. In the first place, radio and the neon light have come forward to aid the nocturnal navigator, although their use is by no means as general as it might be. By means of radio a pilot can be guided home through the murkiest of nights. All the pilot has to do is to send a signal that he is lost. Two wireless stations pick the message up and both

telephone it to the nearest airport where, by triangulation, the exact position of the plane is determined. The pilot is then told the direction of the airport and the course he must fly on to reach it, his position in the air being checked up repeatedly until he is eventually steered into port. But if thick mist is lying on the ground, how can he land? The neon light, with red rays reaching through the fog, answers the question; it is said that these lights sunk into the ground will enable the pilot to make a landing over them in the worst mist, but the process is still in its experimental stage and the neon light is used mostly for beacons.

Engine failure is, of course, the greatest risk the night pilot has to run. If the engine fails in the daytime, he can usually manage to come down more or less safely, but on a dark stormy night all he has to rely upon in case of a forced landing are his landing lights which, situated on the wingtips, shed a considerable light and may enable a pilot to land in a field. However, the time limit is short and in mist or fog these lights are worse than useless, having the effect of blinding the pilot.

Emergency landing grounds equipped—if they prove practicable—with neon floodlights, seem for night passenger services the only solution of the problem of forced landings. It seems not improbable that along passenger airways landing grounds will be placed close enough together so that a plane flying at a convenient height will never be out of gliding distance of one, certainly not for any appreciable time. And until some reliable mechanical landing device has been invented such improvements seem to offer the only way of making night flying as safe as day flying.

How, it may be asked, does a pilot navigate at night when he can see nothing, or not enough to follow any natural feature on the ground? How did Lindbergh fly from San Diego across the continent to New York? He did it, at night, by what is known as instrument flying, which was first developed in a very primitive way by the night flying squadrons in France. The night pilot depends for his direction on his compass, and if it be an earth induction compass, whatever changes take place in the wind's direction he will be able to correct them; for the compass will instantly show any deviation from left to right of a given course. To keep a course accurately requires continuous concentration of the most exhausting kind. But this is not the only instrument the pilot has to watch. If you climb into a pilot's cockpit in any fully fitted plane you will find the front dashboard covered with instruments, with others underneath it and to the side. To all these except two the pilot will pay only perfunctory attention. The two that he must watch as closely as the compass are the bank and turn indicator and the inclinometer.

It is a curious thing that in flying "blind" either in daylight or at night man has not enough natural sense of balance to keep a plane in its normal flying position. If you go up in the daytime and practice flying through the clouds without looking at your instruments, you will most likely be surprised, despite the fact that you know something is wrong, to find yourself actually flying upside down when you emerge from the clouds. It is the same in a black night when no lights are to be seen. You feel you are diving and you pull the stick

toward you to bring the nose of the plane up, whereas you probably were stalling and suddenly you feel your stick go quite limp. Then you feel that the plane is turning and you attempt to counteract it and very probably speed up the turn instead of correcting it. Without instruments there is no way of telling what you are doing, and even with instruments one has such strong feelings that they are wrong and you are right that there is ever a strong temptation to take the matter into one's own hands—with disastrous consequences. Thus an intensive concentration on one's instruments has to be bolstered up with inflexible will power.

The bank and turn indicator shows the pilot when he is and is not flying laterally even; that is to say, when one wing goes up and one down, or when the plane side-slips to one side or the other, the fact is recorded on the instrument and the pilot is able to correct it. The inclinometer similarly tells the pilot when the plane is flying level fore and aft. Now there is available an instrument that performs both these functions and at the same time acts as a compass. It is a French device and is called a gyroclinometer. When the plane is flying normally a light behind the disk that forms the face of the instrument is in a dead centre position; if the plane moves in any direction, up or down, to left or right, that fact is immediately recorded by the instrument and the pilot can make the necessary movements to counteract it. But the instrument demands the same intensity of concentration as the others.

Night flying calls not only for special training but for a special type of man. Not every good day pilot makes a good

night flier. The night pilot must, in addition to many other requisite qualities, be a man of iron nerve well able to withstand the strain of flying weary miles by instrument alone; he must have the faculty of cool, rapid judgment, and he must be an expert flier in the daytime. As a matter of fact the pick of airmen are the night pilots.

The training of night pilots should involve, but sometimes does not, a long course of special instruction. It is only fair to say, however, that most aviation companies in this country employ only the most expert fliers on their night lines, and any passenger who makes an air trip after dusk may be generally well assured that he is in the best hands. Presuming that a pilot has graduated in day work, the normal procedure is to allow him to "pile up" several hundred hours of flying experience in the daytime. Then he practices landings at dusk, then at night in the moonlight period, and finally into the bright floodlights on a dark night. Next he is taught instrument flying, at first through clouds and afterward in a covered cockpit in which he can see only the instrument—a method invented by a Dutch commercial air line. Behind him is his instructor—the only one he really needs in all his night flying work—to tell him when he goes wrong, as he is almost sure to do. It is a long process, but it rounds out a man's knowledge of the air, and no would-be pilot need think for a moment that he will get far without qualifying as a night pilot, and to become first a good day pilot and then an experienced night pilot takes several hundreds of hours of flying time.

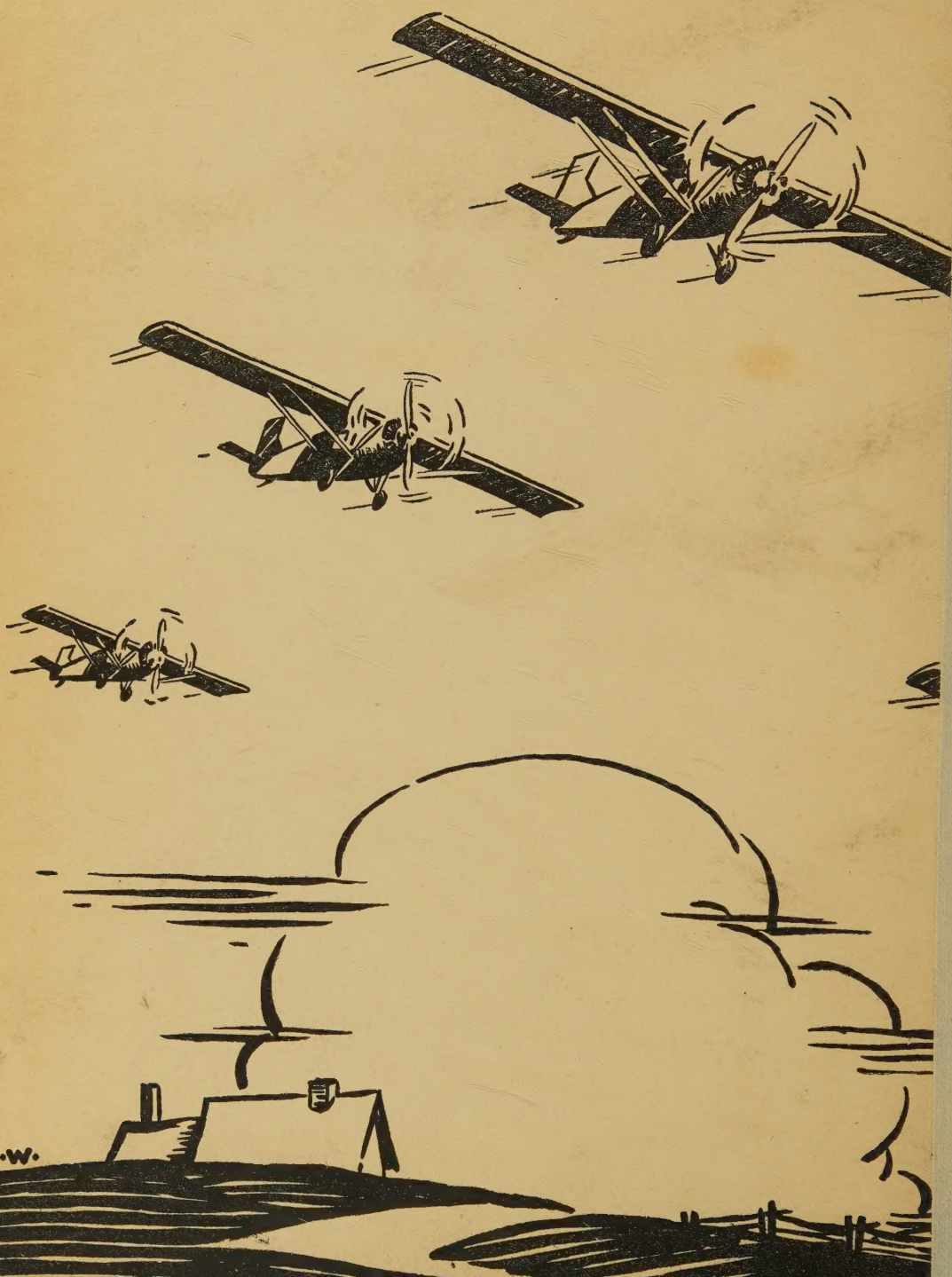
For the passenger no air experience is necessary before he takes his first night flight. If, for example, you go up for the first time on a pitch-black night you will probably find less thrills in flying than you will in the daytime. For one thing there are rarely any bumps, and although bumps are nothing to be worried about, they are unpleasant, especially to the person who is not flying the machine. But the chief reason for lack of thrills is that there is nothing to be seen, and an air journey of any length is apt to be rather monotonous than thrilling. The result is that if you happen to have no weighty problems of your own on your mind you will most probably fall asleep.

If you are a business man and believe that time is money you will at some period or other fly through the night with every assurance that you will land at your destination not only safely but with a punctuality unsurpassed by any other form of travel.

Night flying is necessary to aviation. There is a tradition in the mail service that a plane never waits on the weather, and if this is a little optimistic it is nevertheless almost true. It may not be long, as time is reckoned, before the same thing will be said of night passenger flying; for in all passenger flying speed and endurance have to be sacrificed to reliability, and it is not too much to expect, if passenger flying is to fulfill its manifest destiny, that reliable planes will roar in increasing numbers through the night skies.

Some Important Dates in Aviation History

- June 5, 1783.....First balloon, flown by Joseph and Etienne Montgolfier.
- September 23, 1852....Henry Giffard (father of the dirigible) made semi-successful flight.
- October 7, 1893.....S. A. Andree, Swedish engineer, flew across Baltic Sea in a balloon.
- July 23, 1896.....S. A. Andree inflated balloon in preparation for trip to North Pole.
- December 17, 1903.....Wright Brothers made first flight with power machine.
- August 8, 1908.....Wilbur Wright made his first flight in Europe.
- September 9, 1903.....Orville Wright achieved flight of over an hour's duration.
- December 31, 1908.....Wilbur Wright made flight of two hours and nineteen minutes.
- July 25, 1909.....L. Bleriot flew over English Channel in thirty-one minutes.
- February, 1911.....First aeroplane used in actual war employed by the United States to observe Mexican frontier near Juarez.
- May 9, 1926.....Commander Richard E. Byrd left from base camp near village of King's Bay in aeroplane for North Pole.
- May 20, 1927.....Charles Lindbergh started his flight to Paris in the "Spirit of St. Louis."
- June 4, 1927.....Clarence D. Chamberlin made flight to Germany.
- March 29, 1927.....Wilkins, on second flight to Arctic forced to land in ice fields—the only forced landing in his three expeditions.
- April 12, 1928.....Bremen trip to the United States.
- August 14, 1928.....Commander Richard E. Byrd starts trip to South Pole.







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